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PROCEEDINGS

OF THE

FIFTH ANNUAL ACQUISITION RESEARCH SYMPOSIUM

JOINT ROBOTICS PROGRAM

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by

Joel Brown and Paul Varian

5th Annual Acquisition Research Symposium of the Naval Postgraduate School:

Acquisition Research: Creating Synergy for Informed Change

May 14-15, 2008

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ACQUISITION RESEARCH PROGRAM
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Proceedings of the Annual Acquisition Research Program

The following article is taken as an excerpt from the proceedings of the annual Acquisition Research Program. This annual event showcases the research projects funded through the Acquisition Research Program at the Graduate School of Business and Public Policy at the Naval Postgraduate School. Featuring keynote speakers, plenary panels, multiple panel sessions, a student research poster show and social events, the Annual Acquisition Research Symposium offers a candid environment where high-ranking Department of Defense (DoD) officials, industry officials, accomplished faculty and military students are encouraged to collaborate on finding applicable solutions to the challenges facing acquisition policies and processes within the DoD today. By jointly and publicly questioning the norms of industry and academia, the resulting research benefits from myriad perspectives and collaborations which can identify better solutions and practices in acquisition, contract, financial, logistics and program management.

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Joint Robotics Program

Presenter: Joel Brown, Defense Acquisition University

Author: Paul Varian, Project Manager, Robotics Joint Project

Introduction

Sun Tzu wrote first about the importance of logistics over two thousand years ago (Griffith, 1963, pp. 72, 74),[1] followed by Von Clauswitz 150 years ago—who again echoed the importance of logistics to overall mission success (Greene, 1943, pp. 136, 179)[2]; now, logistics is a *Defense Acquisition Workforce Improvement Act* functional area. Since Sun Tzu, much literature, many experiments, lessons learned, and the DoD's continual searching for better logistics answers have stressed the continued importance of getting the right things to the right place at the right time. Much like human transportation history evolution—beginning first with people walking or running from point a to point b, followed by thousands of years being transported by real "horse" power, then automobiles, airplanes, and rockets—logistics too has progressed over the years: focusing first on Mass-based Supply, then Just-in-Time Supply Chain Management, and now on Sense and Respond logistics.

The Robotic Systems Joint Project Office (RSJPO), an Army-Marine Corps effort that supplies various robots to the AORs of Iraq and Afghanistan, has also evolved through the three logistics methods. During each approach, many positive benefits were discovered. Along with those benefits, there were and are still today challenges to be confronted and overcome. The Robotics Program's experience and lessons learned since it began "real time" theater support in 2003 can aid all logistics programs by exemplifying the better ways to provide the best logistics with the knowledge, skills, and tools available today. All logistics functions, as shown by the Robotics Program, can be provided incredibly fast, quite inexpensively, and with superior quality and customer satisfaction.

Mass-based Inventory

For many long years, logistics relied on provisioning and sparing as the logical answer to supporting any weapons system. Numerous logisticians were trained in the art and science of sufficient inventory and spares, which would keep systems functioning for the fielded units anytime and anywhere. Budgets were predicated against these projected numbers. Many logisticians established careers tracking, analyzing, projecting, adjusting, and readjusting Mass-based Support for all weapons systems. This logistics approach did provide weapons system support that could function appropriately in the field (Van Creveld, 1977, pp. 206, 214). Warfighters (customers) were required to learn which spares were critical and in what numbers, while also trying not to have too much inventory of all the wrong things lying about taking up needed space and expending too much available budget. The robotics program first began by

[1] Sun Tzu gives the projected costs for supporting war efforts as well as stating logistics for his time equated to 60% of the total costs incurred.

[2] Von Clausewitz surmises total war requires everything relates, including logistics, to providing the soldier at the right place at the right time to be perfectly effective.

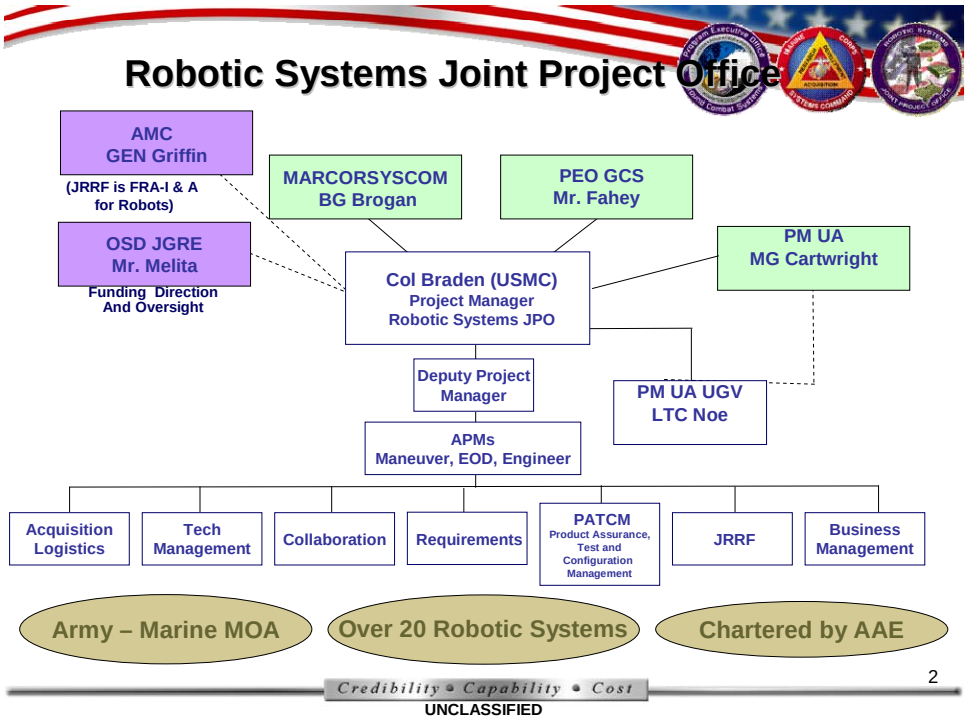
utilizing Mass Based logistics to support the initial fielding of 162 robots. Since the majority of suppliers were small businesses (in DoD parlance, "Mom & Pops") and were finding it difficult to spare or keep up with production, the Program Manager declared that a portion of the total available robots would function as spares. Central Command (CENTCOM) controlled all robots as theater-provided equipment (TPE), rather than granting one of the Services total ownership. However, as the robots were fielded, Command found that the robots worked exceptionally well and replaced warfighters in critical danger missions. The Services would not release critical robotic assets and demanded many more robotic platforms be sent into the field. Very quickly, CENTCOM and the Project Manager realized Mass Based Logistics would not support well the customer's demand. Another logistics approach was quickly required. What support program would allow the small businesses to produce, supply, and keep up with an ever-increasing field demand?

Just-in-Time

Just-in-Time (J-I-T) logistics support promised to better align suppliers with customers in providing the right item at the right time in the right place. J-I-T also promised to reduce inventories and spares to near zero. In order to achieve these objectives, quality would need to be more strictly monitored; deliveries would need to be timed better; suppliers would need real-time communication with the customers' system to better predict when they needed to provide needed items. Production needed to be stable so suppliers could more easily meet demand (Kotler, 1997, pp. 214-215). The Robotics program moved toward J-I-T within six months as Massed-based supply could not keep up. The Project Manager and Suppliers gathered data on which robotic parts lasted or failed and how often. Often, the same supply approach (one new robot for one damaged or eliminated robot) was carried over from the Mass-based Approach. Rebuilding damaged robots grew from the J-I-T approach. Both the Project Manager and the Robotic Suppliers needed faster and more accurate information each day. Tracking robots and their status and location in the field became a pressing point. No in-house DoD information system existed to provide this ever-increasing communication need. The Project Manager partnered with Avantix and T&W Communications to create the Catalog Ordering Logistics Tracking System (COLTS) program. The program utilizes UID formats and capabilities to provide the Project Office, as well as the suppliers, with critical, daily information to meet the warfighters' demands. The J-I-T approach provided more accurate robot fielding. Separate warfighter units only received robots that were truly mission required, rather than potentially hording robots as back ups. The logistic footprint was reduced as robots were repaired, rebuilt, or supplied as needed. The biggest challenge for the Robotic Project with J-I-T was caused by interruptions or breaks in the transportation chain—disruptions to the process of getting required robots to their place of need. This is a story we're all familiar with in air travel: one weather delay for the airlines causes a major ripple effect to all airlines and passengers trying to get to the right place at the right time. Once again, the Robotics Program needed another improved logistics solution!

Sense and Respond

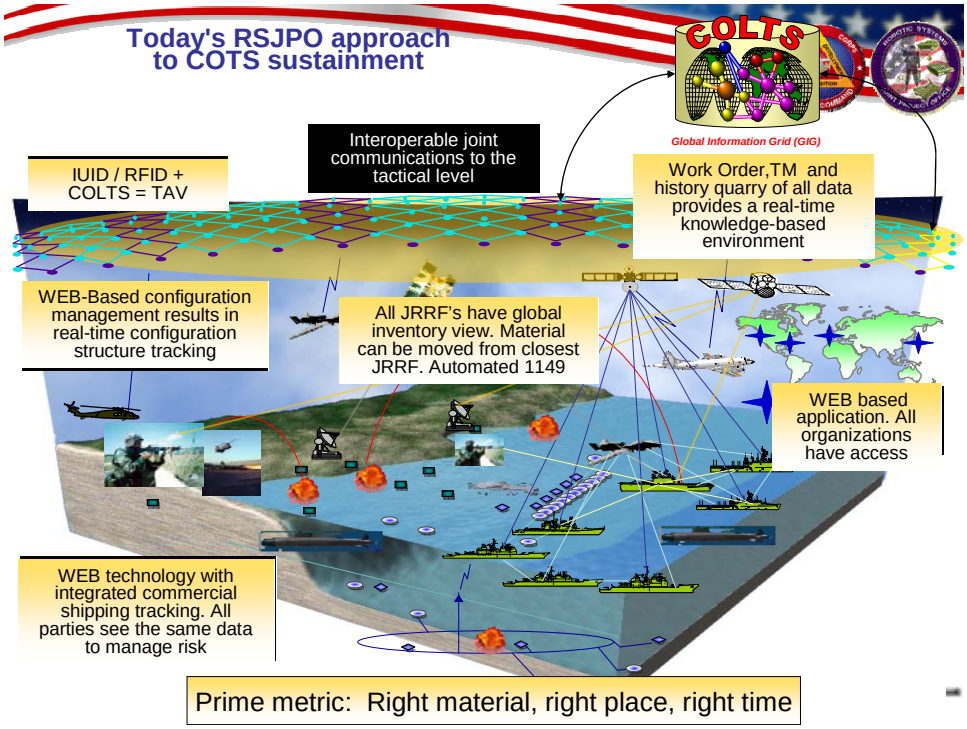
This Sense and Respond section will flow from a TAV brief given at TACOM in Winter 2007 by the current Robotics Program Manager (Varian, 2007). Sense and Respond logistics arose from the inability of J-I-T to completely satisfy the warfighter customer.



The relationship/JPO chart shows how the Robotics System Joint Program fits into the joint Army/Marine PEO. Joint Robot Repair Fielding (JRRF) is just one of the areas necessary for total Program success.

- **Provide in-Theater Support for Joint Service Theater Provided Equipment (TPE) Ground Robots.**
- **Single "Belly Button" for OIF/OEF Training, Sustainment, Assessment, and Accountability**
  - **162 Bots (2004) - 1800 Bots (2005) - 4300 bots (Now) - 6000+ est'd (2008)**
- **Pre-Deployment Training Sites; JRRTs; and Mobile Training Teams – *Joint Reserves (61%)***
- **4 Hour Robot Turn-Around Standard – *Leveraging "Joint Float Pool Concept"***
- **Web-Accessible Real-time Supply Chain Management with integrated IUID/RFID – *Key step toward sense and respond logistics***
  - **Accountability - Parts Reordering - Reliability Tracking - Trouble Desk Info**
- **2007 Robotic Measures of effectiveness – Robots save lives**
  - **25,000 (+) IED Missions Conducted; 15,000 (+) found and cleared with ground robots; 150 Robots Destroyed**

The above graphic relates the Robotic program and explains how the customers' needs continue to rapidly expand. The Program has instituted no more than four hours for any robotic replacement, anywhere, anytime.



The figure above relates how the COLTS software program specifically helps achieve the overall goals for Sense and Respond. It is the full implementation of COLTS that allows IUID/RFID to provide a Total Asset Visibility (TAV). To facilitate Sense and Respond, TAV and real-time information flow will be critical to sustainment of tomorrow. The following chart provides the driving tenets for all people involved with the Sense and Respond Robotics logistics support.

What Joint Robotics Repair Facility Is Doing

1. Define the **WAR-FIGHTER** : As the private or crew member in the heat of it.

2. Understand what is important to the WAR-FIGHTER:

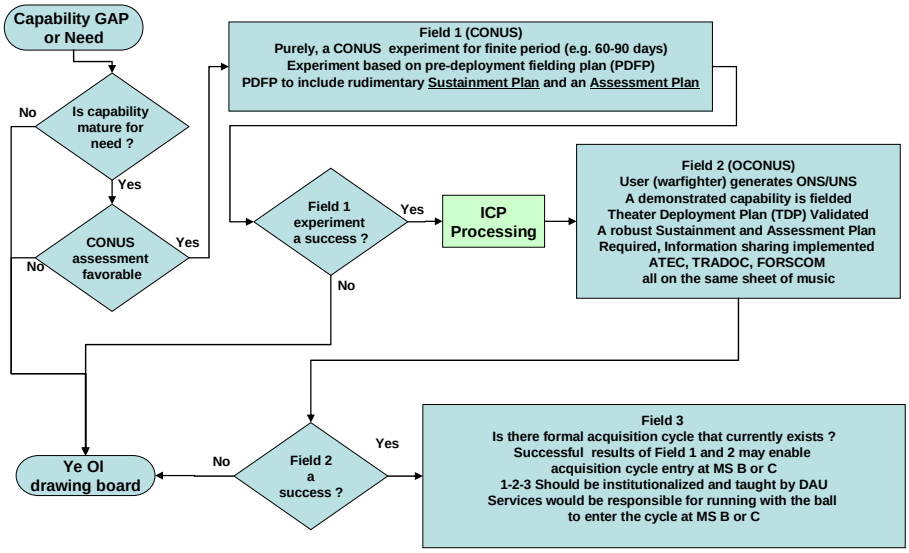
   Time
   Equipment that works
   Time

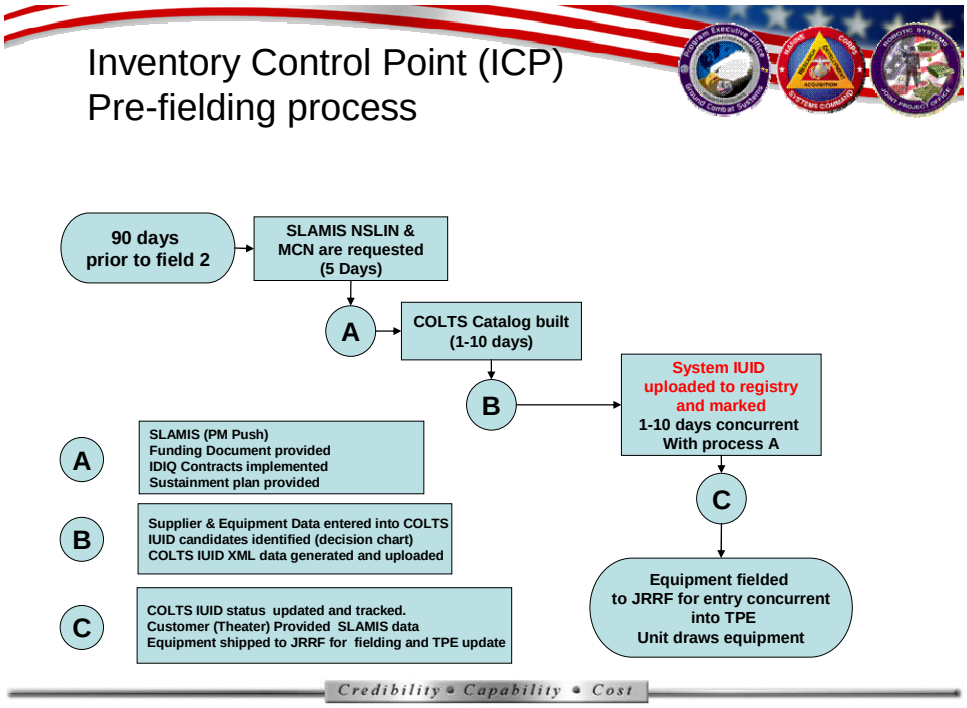
3. Define PBL in a term the WAR-FIGHTER understands.

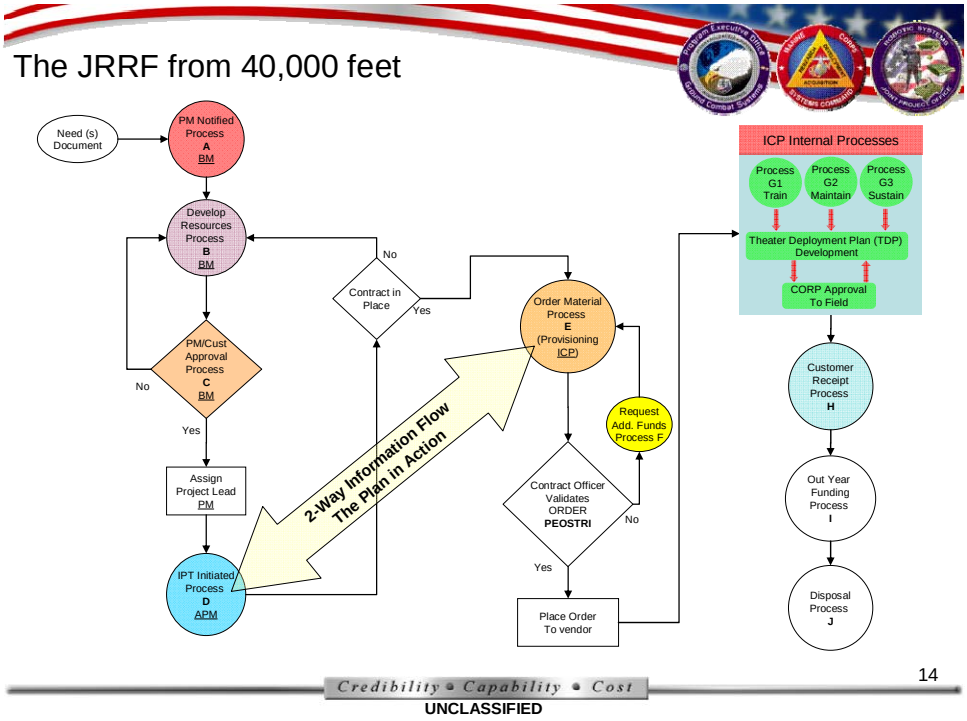
   We structure our support to be reactive to the private or crew member in the heat of it. The WAR-FIGHTER receives a robot in 4 hours or less. PERIOD

By defining processes, the following charts illustrate how the Robotics Program office achieves the above program goals.

1,2,3, Process Flow







The Robotics Program has completely embraced the IUID (Item-unique Identification) method and is continually discovering capability benefits from the warfighter all the way to the supplier and back again. The following presents just some of these capabilities.

COLTS (SCM) value to the RSJPO

- Integrated IUID capability. COLTS **USES** the data not just generates the data.
  - Vendors see data and have "buy in" with the IUID process
  - Ability to mark equipment "on site" virtual IUID NOT REQUIRED
- WEB Based centralized database: There is no requirement to "exchange" between databases. It is one stop for common tasks
  - Email notification on trigger events
  - Equipment modification notification generated and tied to equipment
  - All stake holders have access to the data and all see the same thing
  - Data exportable to Excel™ and data interchange is possible i.e. DAASC, ULLS, etc.
  - Reports generation automatically or data mine to customize
- Configuration management up to 15 levels
- Consumption tracking:
  - Real-time parts usage and consumption data.
  - Real-time maintenance data (TTR, Man-hours, WO processing, etc)
- 100% Property accountability:
  - All items are assets. As such nothing is "forgotten" items are always "issued" or "transferred" but never forgotten

Credibility • Capability • Cost

We could spend a great deal of time relating what the Robotics program has achieved by presenting numerous charts and graphs of how improvements have been made over the course of the program. But rather than take up valuable time and space, we thought just the bare facts presented below say it all…

Return on Investment

- A misplaced hyphen cost $280K
- IUID enables Serialized Item Maintenance (SIM is a DoD Mandate)
  - IUID Enables real time configuration management
  - IUID Saves repair parts cost
    - Aug 06-Mar 07 $29M for repair parts on 1 vendor
    - Aug 07-Mar 08 $ 5M for repair parts on same vendor
- IUID eliminates human induced error
  - Average human has a typing error rate 5.47%. For every 100 key strokes 6 will be wrong

Credibility • Capability • Cost

UNCLASSIFIED

Just the facts (1 Jan 07 – 1 Dec 07)

- COLTS Supply & Maintenance Data
  - 6073 Work orders completed
  - 26,375 maintenance actions
  - 64,419 Inventory events (Parts movement)
  - 78,467 Asset events (Robot actions/movement/repair, etc)
  - 4,816 Items shipped
  - 64 EOD/Engineer robots rebuilt from a destroyed condition. Cost savings approximately 3.2 million dollars.
- IUID integration saves the RSJPO time, money and ultimately lives on the battlefield.
  - No more “lost” data due to human error
  - Shorter repair cycle time as a result of IUID “scan in & scan out”
  - More fidelity of data tracked in COLTS due to IUID decision process.
  - Routine logistics processes streamlined with IUID and hand scanner.
  - Configuration management integrated with all SCM actions. SIM is a reality
- Operational rate on all NS-E/COTS supported platforms has been in excess of 98% since Apr 05.
- In excess of 3307 soldiers trained on robotics operation

Credibility • Capability • Cost

What more need we say about Sense and Respond logistics and the benefits it has provided to the warfighter?

Conclusion

Many presenters and numerous authors continue to assert the rate of change in our era will continue to geometrically expand. The Robotics Program since 2003 has rapidly traversed through Mass-based, Just-in-Time, and Sense and Respond logistics approaches, always trying to improve support to the warfighter. Each logistics approach provided benefits and challenges. Each moved into another logistics support scheme built on the previous lessons learned and added new features—with the final goal of reducing the logistics footprint, expending less dollars, and providing the best equipment (which works well when required) to the right warfighter at the right time. The next chart captures each logistic approach and explains why another approach was sought.

Even now, the Robotics Program's Sense and Respond approach is not the final logistics answer. New features (active and passive RFID among others) are being tested, data are being gathered and analyzed, and better processes are being implemented to continually improve the Program's logistics. Other DoD and industry programs should take note and seek out people from this Robotics Program in order to discover better ways to fully support the warfighter. The perfect logistics answer is still to come.

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- Managing Services Supply Chain
- Acquiring Combat Capability via Public-Private Partnerships (PPPs)
- Knowledge Value Added (KVA) + Real Options (RO) Applied to Shipyard Planning Processes
- Portfolio Optimization via KVA + RO
- MOSA Contracting Implications
- Strategy for Defense Acquisition Research
- Spiral Development
- BCA: Contractor vs. Organic Growth

Contract Management

- USAF IT Commodity Council
- Contractors in 21st Century Combat Zone
- Joint Contingency Contracting
- Navy Contract Writing Guide
- Commodity Sourcing Strategies
- Past Performance in Source Selection
- USMC Contingency Contracting
- Transforming DoD Contract Closeout
- Model for Optimizing Contingency Contracting Planning and Execution

Financial Management

- PPPs and Government Financing
- Energy Saving Contracts/DoD Mobile Assets
- Capital Budgeting for DoD
- Financing DoD Budget via PPPs
- ROI of Information Warfare Systems
- Acquisitions via leasing: MPS case
- Special Termination Liability in MDAPs

Human Resources

- Learning Management Systems
- Tuition Assistance
- Retention
- Indefinite Reenlistment
- Individual Augmentation

Logistics Management

- R-TOC Aegis Microwave Power Tubes
- Privatization-NOSL/NAWCI
- Army LOG MOD
- PBL (4)
- Contractors Supporting Military Operations
- RFID (4)
- Strategic Sourcing
- ASDS Product Support Analysis
- Analysis of LAV Depot Maintenance
- Diffusion/Variability on Vendor Performance Evaluation
- Optimizing CIWS Lifecycle Support (LCS)

Program Management

- Building Collaborative Capacity
- Knowledge, Responsibilities and Decision Rights in MDAPs
- KVA Applied to Aegis and SSDS
- Business Process Reengineering (BPR) for LCS Mission Module Acquisition
- Terminating Your Own Program
- Collaborative IT Tools Leveraging Competence

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Creating Synergy for Informed Change

Joint Robotics Repair & Fielding

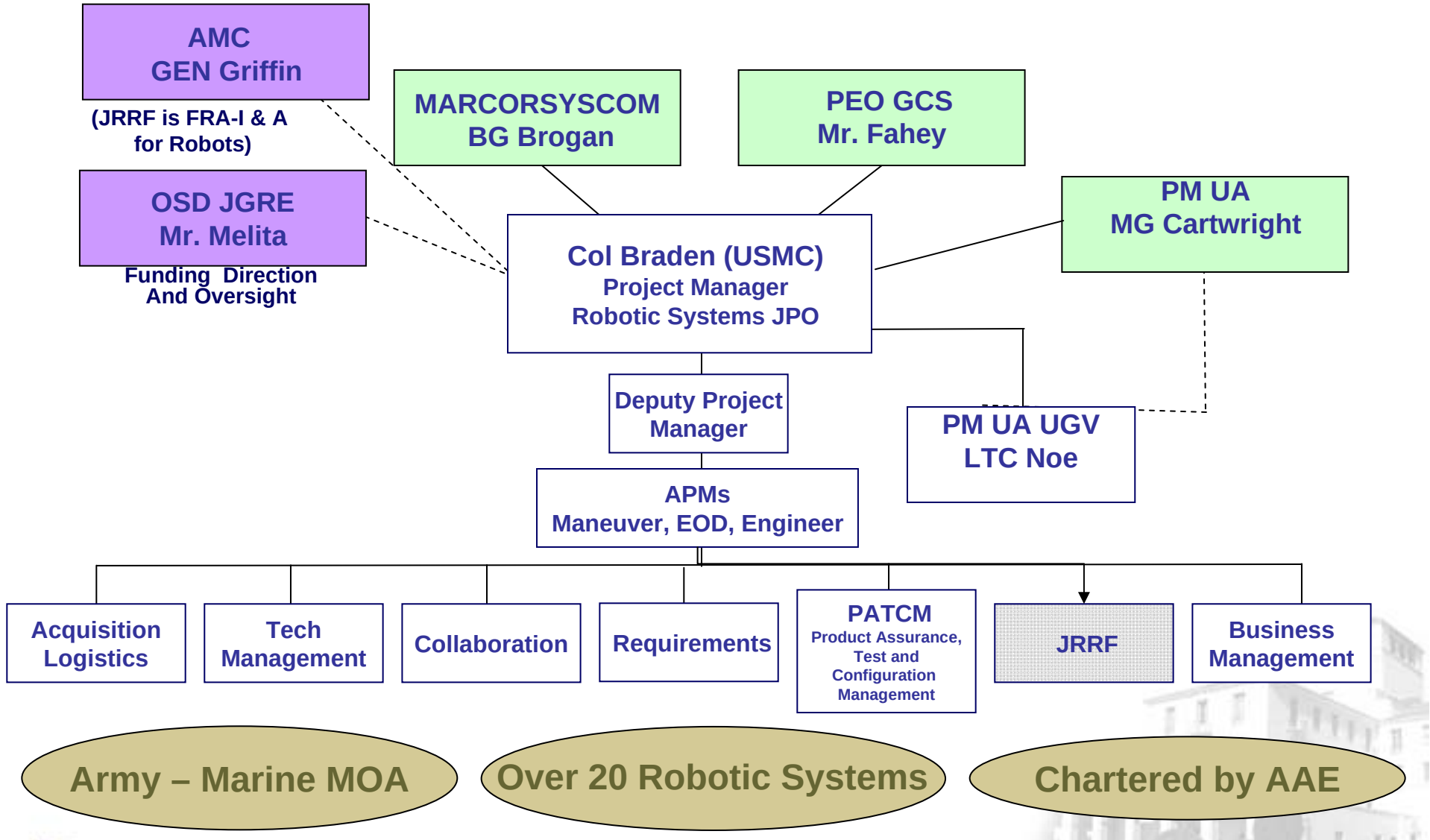
Mr. Paul Varian

JRRF Division Chief

Robotic Systems
Joint Project Office

15 May 2008
Mr. Paul Varian

Robotic Systems Joint Project Office



Army – Marine MOA

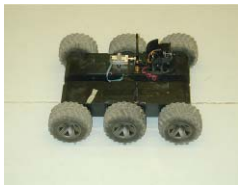
Over 20 Robotic Systems

Chartered by AAE

Joint Robot Repair Fielding (JRRF)









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  - **Accountability** - **Parts Reordering** - **Reliability Tracking** - **Trouble Desk Info**

2007 Measures of Effectiveness (OIF/OEF)

# of Missions	# of Found & Cleared IEDs	# of Destroyed Robots
25,000 +	15,037	150

- **26,000 Robot Maintenance Actions**
- **Find and Clear Rate is Approximately 61%**
- **SOP is to Employ a Ground Robot first**
- **Bomb Suits Only used When Terrain Prevents Robot Employment**

Training at 0900 hours

The robot “crew member” 6 hours later

JRRF-Iraq (Camp Victory)

Approaches to Logistics

Yesterday (Mass-Based)

- More is better
- Mountains of stuff measured in days of supply
- Uses massive inventory to hedge against uncertainty in demand and supply
- Mass begets mass and slows everything down

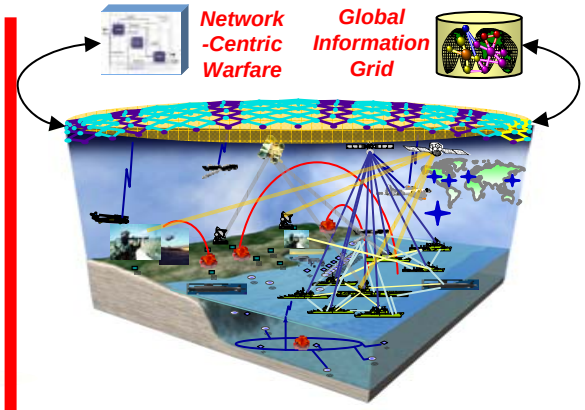
Prime Metric:
Days of Supply

Today (Just-in-Time)

- On-time is better
- Inventory is reduced to a minimum and kept moving
- Uses precise demand prediction and static optimization to purge uncertainty
- Works great, except when it doesn't

Prime Metric:
Flow Time

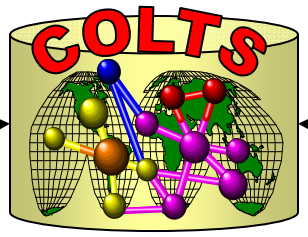
Tomorrow (Sense and Respond)



- Adaptive is better
- Inventory is dynamically positioned throughout
- Uses transportation flexibility and robust IT to handle uncertainty
- Initial S&R models look promising
- Supports distributed, adaptive ops

Prime Metric:
Speed/Quality of Effects

Today's RSJPO approach
to COTS sustainment
Tomorrows Logistics
Knowledge-enabled, demand driven
Sense and Respond



Global Information

Interoperable joint communications to the tactical level

IUID& RFID + COLTS = TAV

Real-time WEB based WO's,TMs', TB's, and history data facilitate the S&R objectives

WEB-Based configuration management result of real-time structure tracking and changing to meet mission needs

All JRRF's have global inventory view. Allowing for Dynamically managed inventories. Material can be moved from closest JRRF. Automated 1149

WEB based application. All organizations have access. Interface with WAWF and DASSC possible

WEB technology provides transaction transparency and IT to minimize and mange risk

Prime metric: Right material, right place, right time

It's all about
Performance Based Logistics (PBL)

The Current (DAU) Definition:

PBL primary tenets are documentation of **WAR-FIGHTER** performance requirements as measurable metrics.

A fraction of the measurable metrics:

Operational Availability, Operational Reliability, Cost per Unit Usage, Total life cycle cost, Logistics Footprint, Logistics Response Time,

YADA, YADA, YADA

What Joint Robotics Repair & Fielding Is Doing

1. Define the **WAR-FIGHTER** : As the private or crew member in the heat of it.

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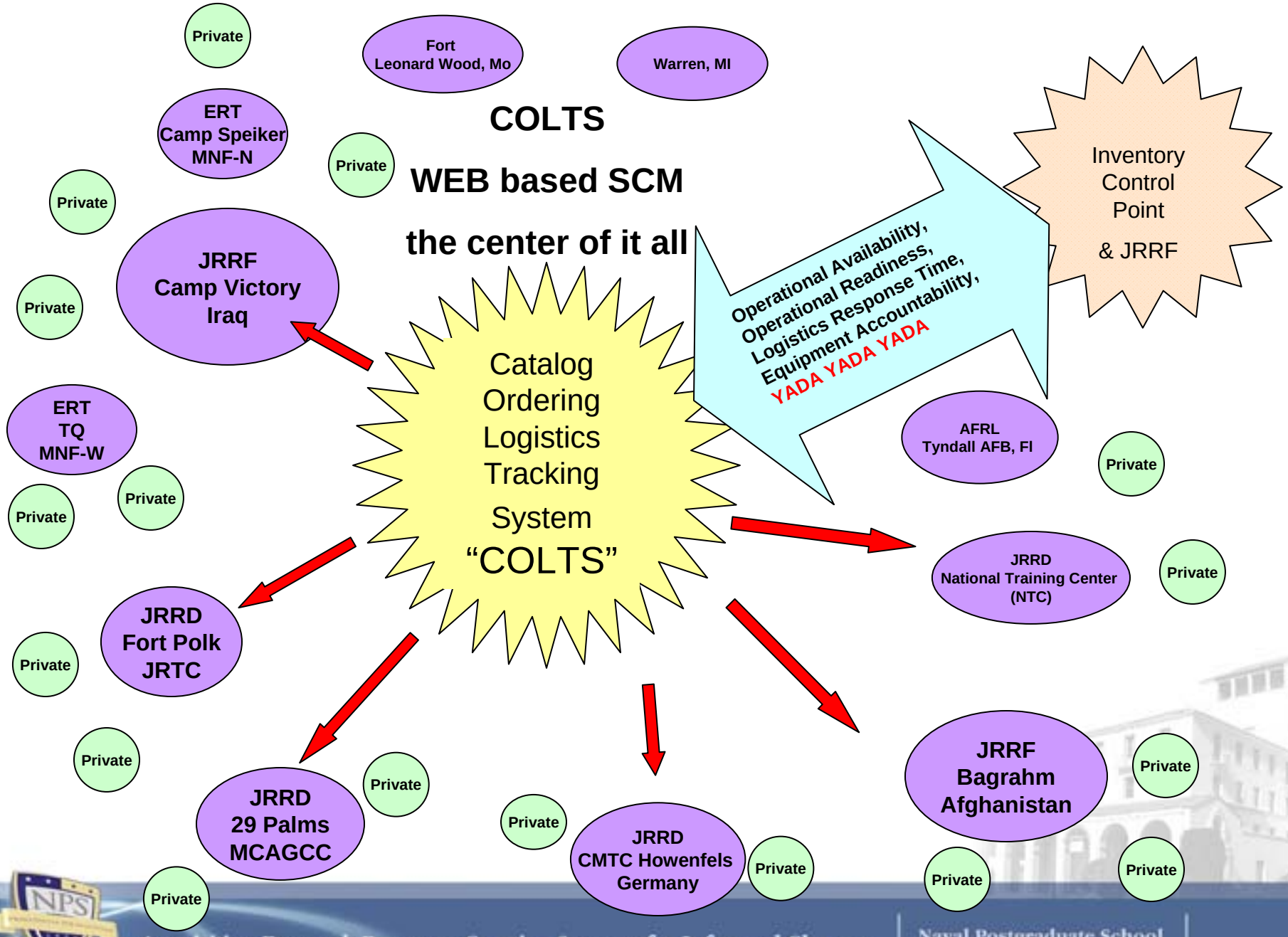
Private
Fort Leonard Wood, Mo
Warren, MI
ERT Camp Speiker MNF-N
Private
Private
COLTS
WEB based SCM
the center of it all
Inventory Control Point & JRRF
JRRF Camp Victory Iraq
Private
Operational Availability,
Operational Readiness,
Logistics Response Time,
Equipment Accountability,
YADA YADA YADA
Catalog
Ordering
Logistics
Tracking
System
"COLTS"
ERT TQ MNF-W
Private
Private
AFRL Tyndall AFB, Fl
Private
JRRD National Training Center (NTC)
Private
JRRD Fort Polk JRTC
Private
Private
JRRD 29 Palms MCAGCC
Private
Private
JRRD CMTC Howenfels Germany
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JRRF Bagrahm Afghanistan
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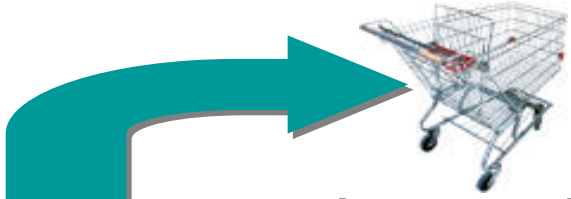
Private

JRRF WEB Based-Supply Chain Management (SCM) System



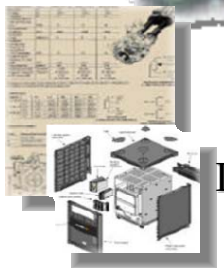
Order Parts - Online Catalog

Record & Manage Robot Maintenance, Repairs & Failures

COLTS

Huntsville ICP Operations

Problem Reporting Knowledge Base for all Repairs and Failures



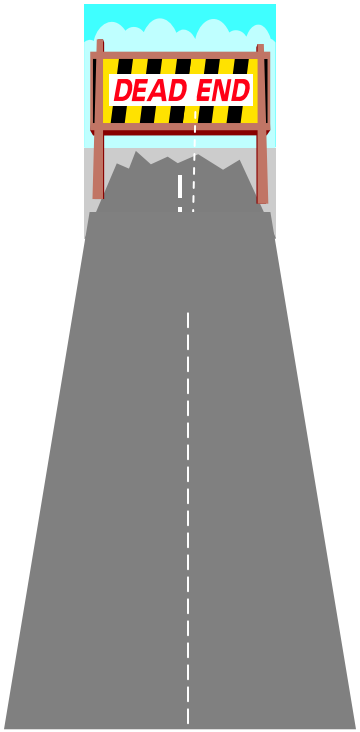
Online Documentation

Inventory and Asset Management at JRRF and ICP

Data (IUID) Don't just generate the data

USE the data

COLTS Supply Chain Management



Implementing IUID without an integrated Supply Chain Management System is a Dead End.

But you will have met DoD requirements!

Your immediate gain will be
… No Savings
… No immediately usable data
… No incentive to comply
… No vendor "buy in"

The challenge is to find a way to implement IUID with your supply chain management system.

…RSJPO is using integrating IUID and our SCM

Making the Data work for you

Mandate and Goals

Under Secretary of Defense (USD) and Army's Product Manager, Joint Automatic Identification Technology (PMJAIT) require compliance with policy mandates for Unique Identification (UID) and Radio Frequency Identification (RFID) technologies for Supply Chain Management:

- Maximize efficiencies of life-cycle asset management with integration of UID/ RFID throughout DoD.
- Leverage technology to improve the ability to get the customer the right materiel, at the right time, and in the right condition
- Critical to the End-to-End War fighter Support Initiative.

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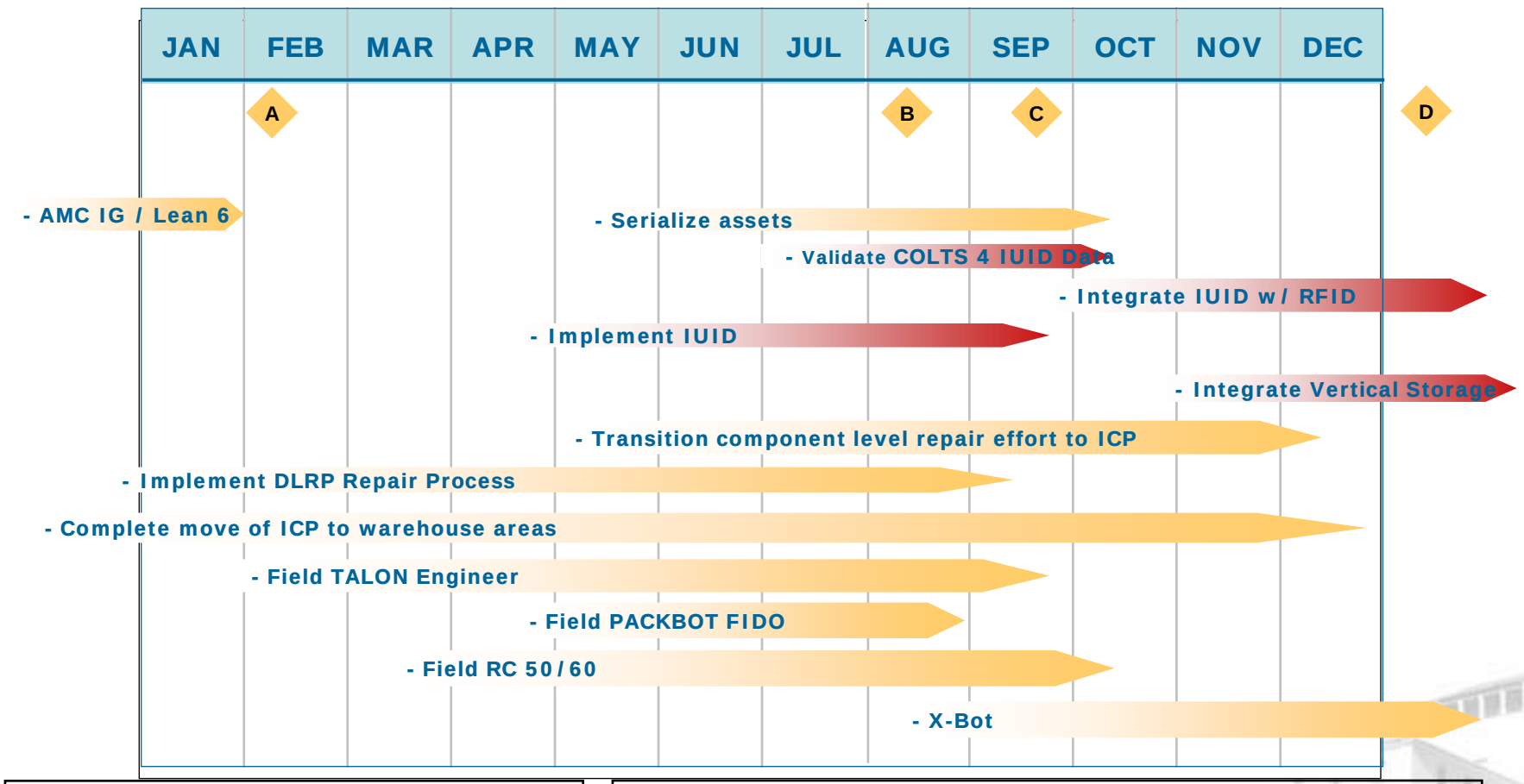
Integrated Solution
IUID and RFID Technologies
With SCM

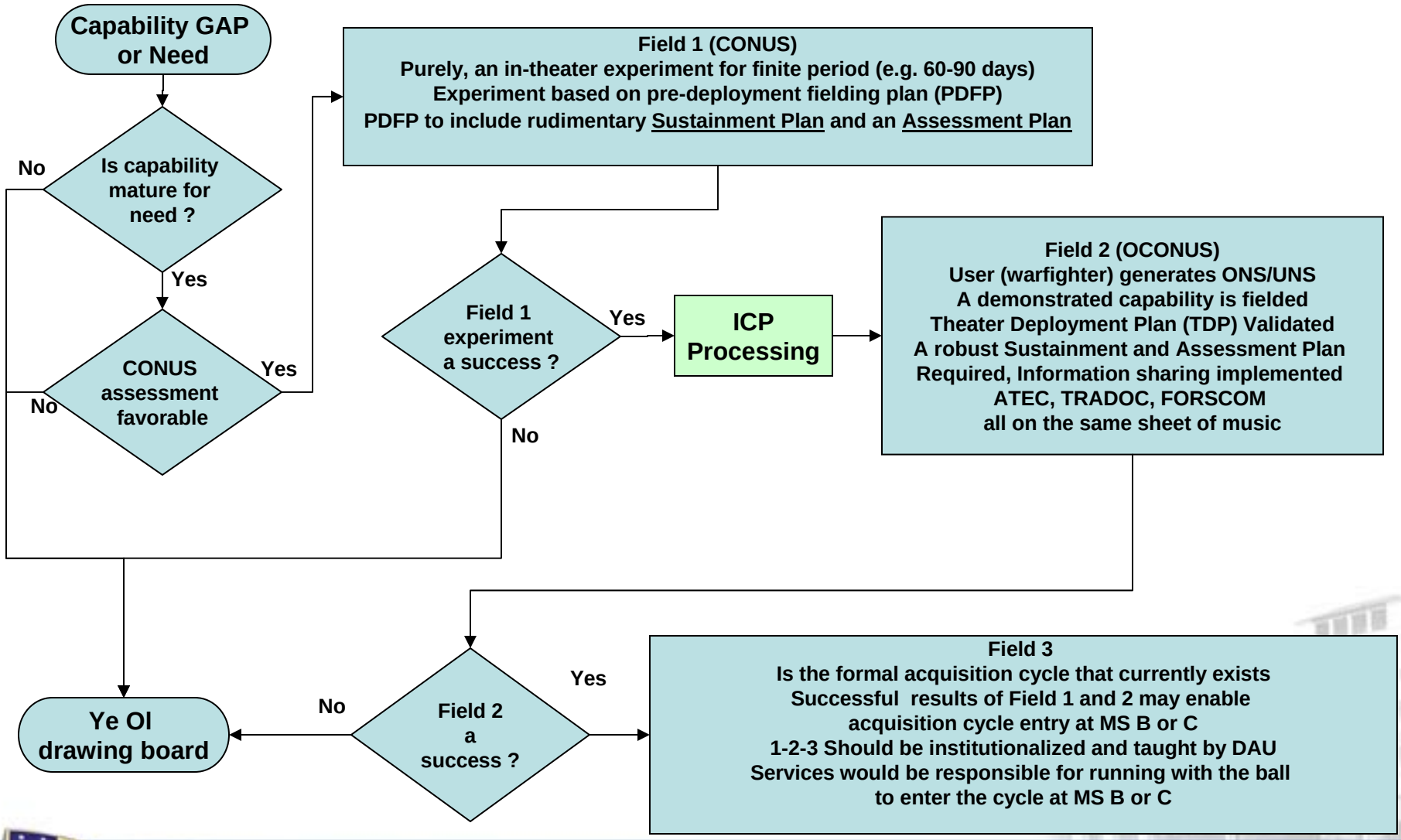
RSJPO Huntsville ICP 2007 Initiatives



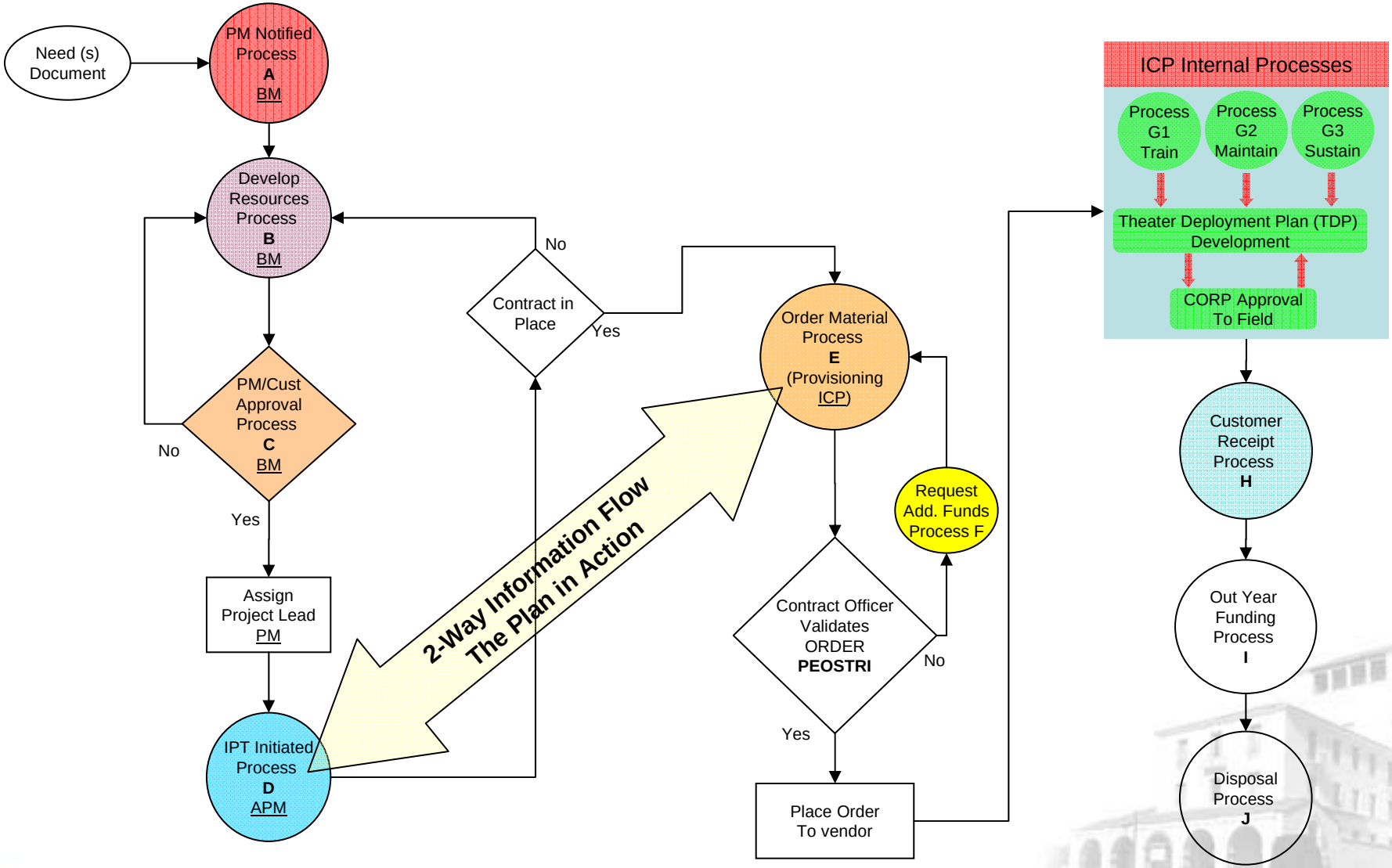
Milestones
A: Survive AMC IG & Lean 6
B: Transition to COLTS 4.4
C: Fully implement IUID
D: Combine RFID w/IUID

Significant Actions
1: Transition to serialized accounting & SIM utilizing IUID as the common thread
2: Implement DLRP Process
3: Continue aggressive fielding and support
4: IUID and COLTS integration completed in less than 5 months

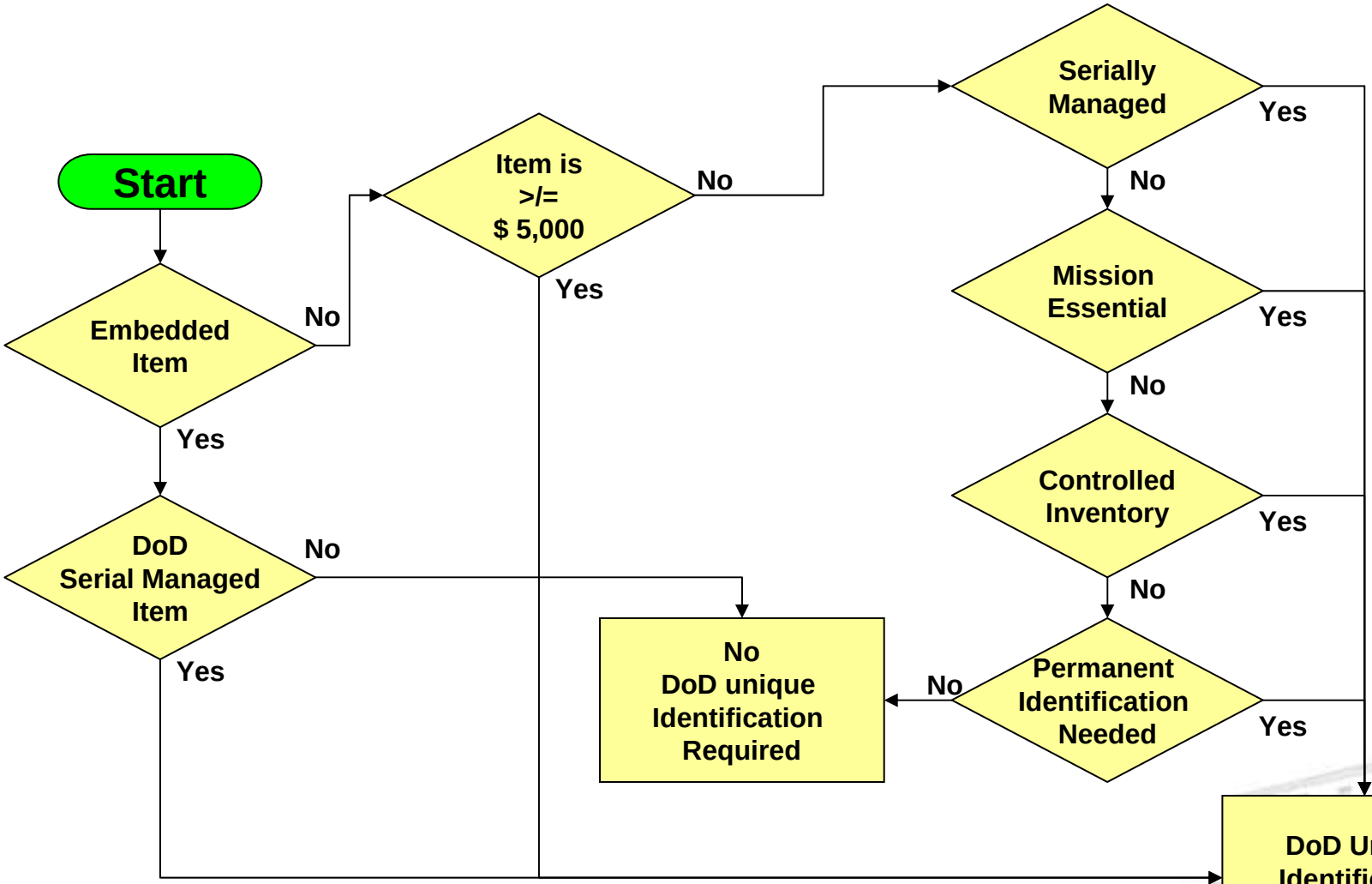
1,2,3, Process Flow



The JRRF from 40,000 feet

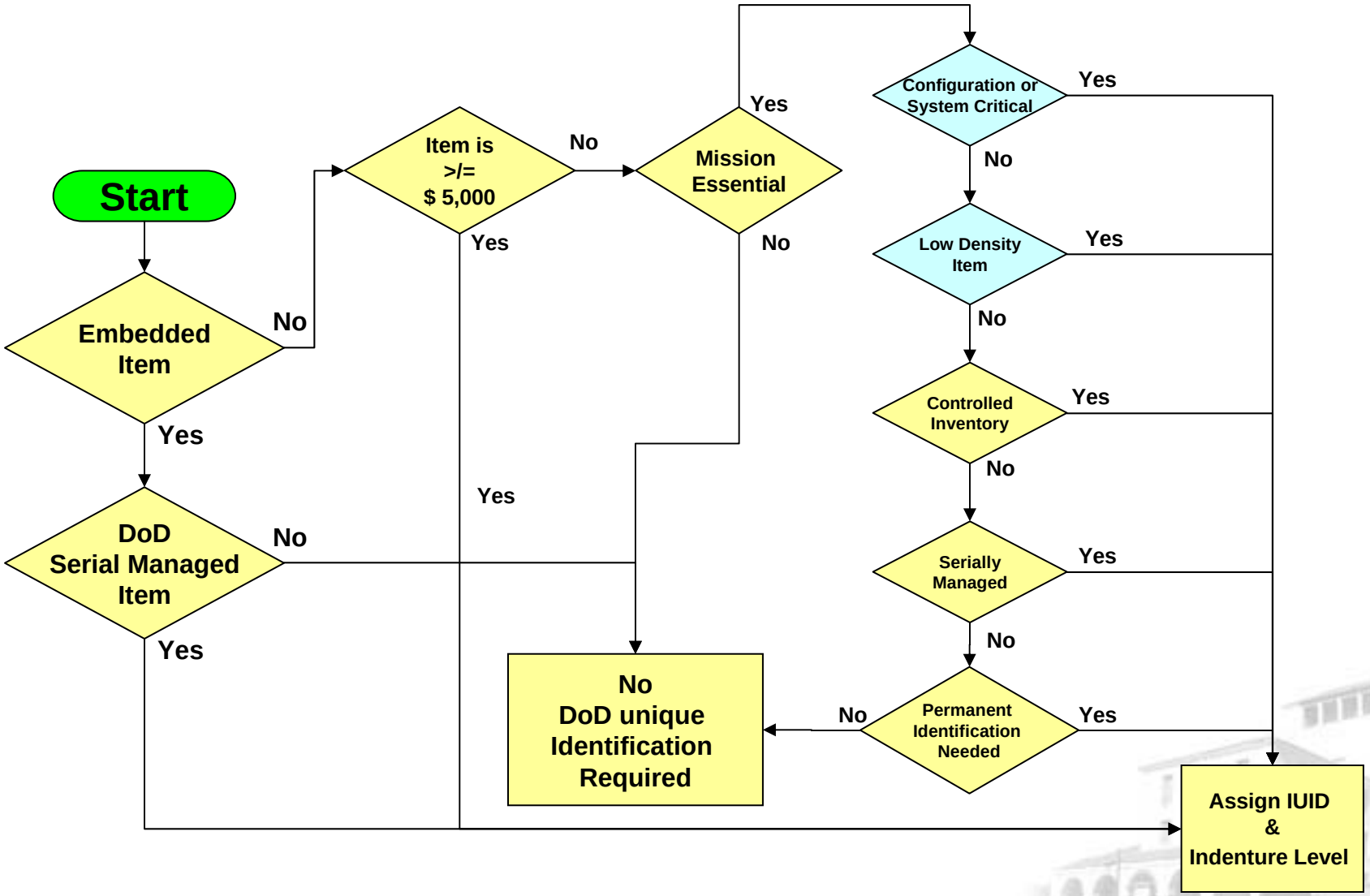


IUID Decision Flow Process



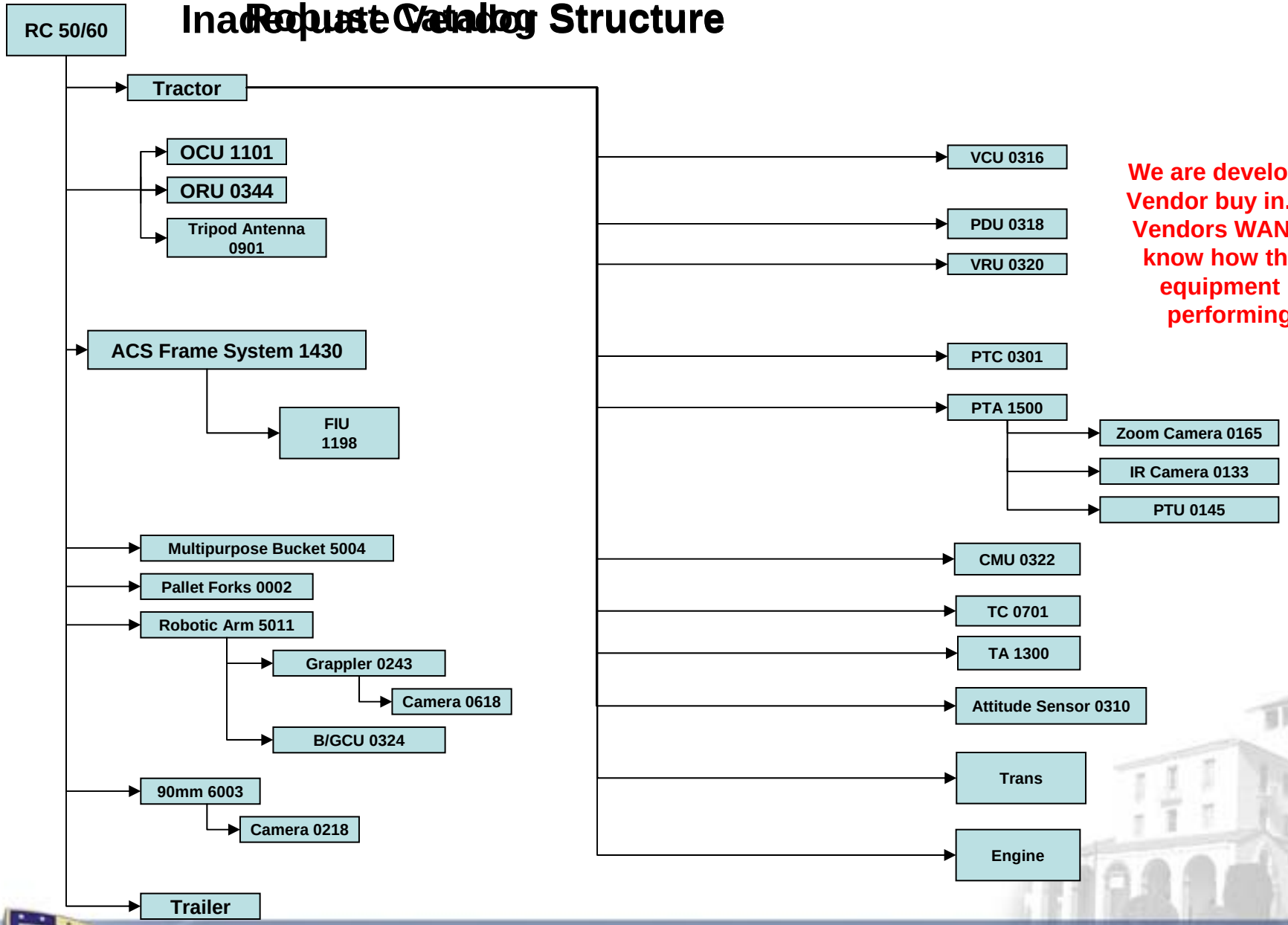
DoD Guide to Uniquely Identified Items V 1.6 1 June 2006

COLTS Catalog build process



RSJPO COLTS Catalog Build Decision Matrix

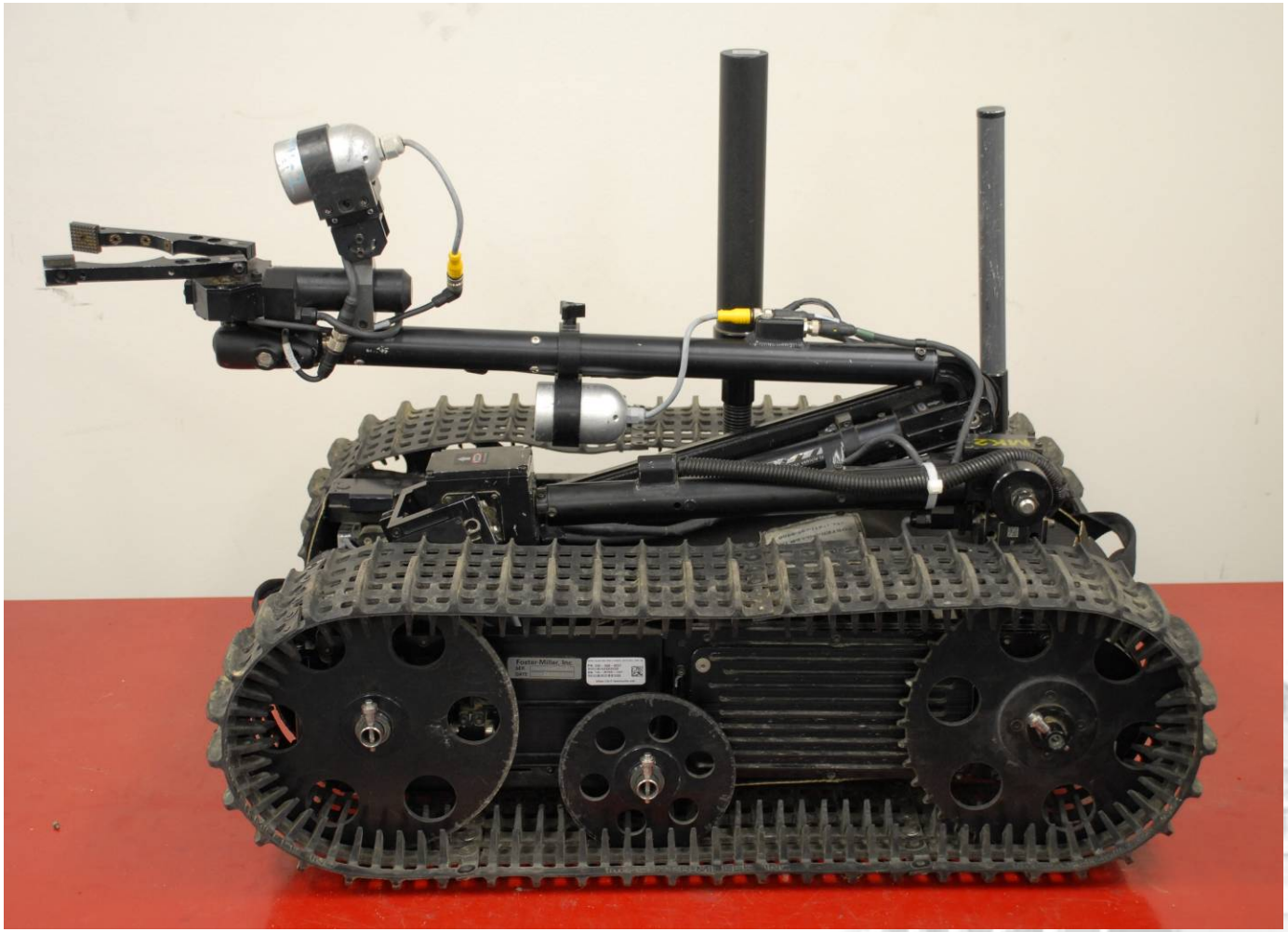
Inadequate Vendor Request Catalog Structure



We are developing Vendor buy in. The Vendors WANT to know how there equipment is performing.

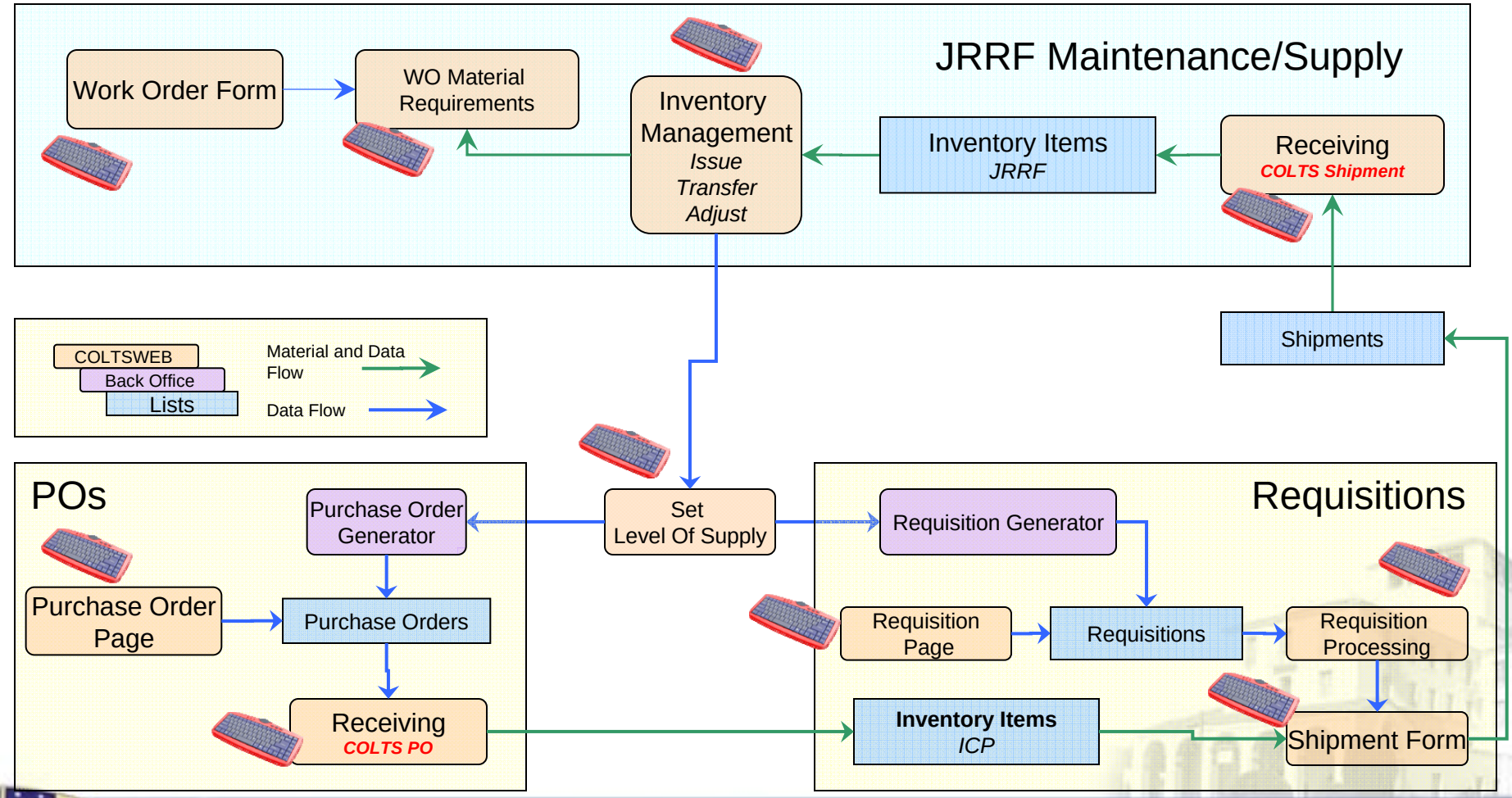
TALON 3B (Engineer and EOD Bot of Choice)

- Talon Engineer
  - Talon Chassis
  - Talon Eng OCU
  - Comms Box Cntl Stack w/o Radio
    - Data R/T Radio
    - Video R/T Radio
  - E-Box Stack
  - Pan/Tilt w/ Mast
  - Arm sub-Assy w/o Gripp, wrist, cam
  - Spool Assy



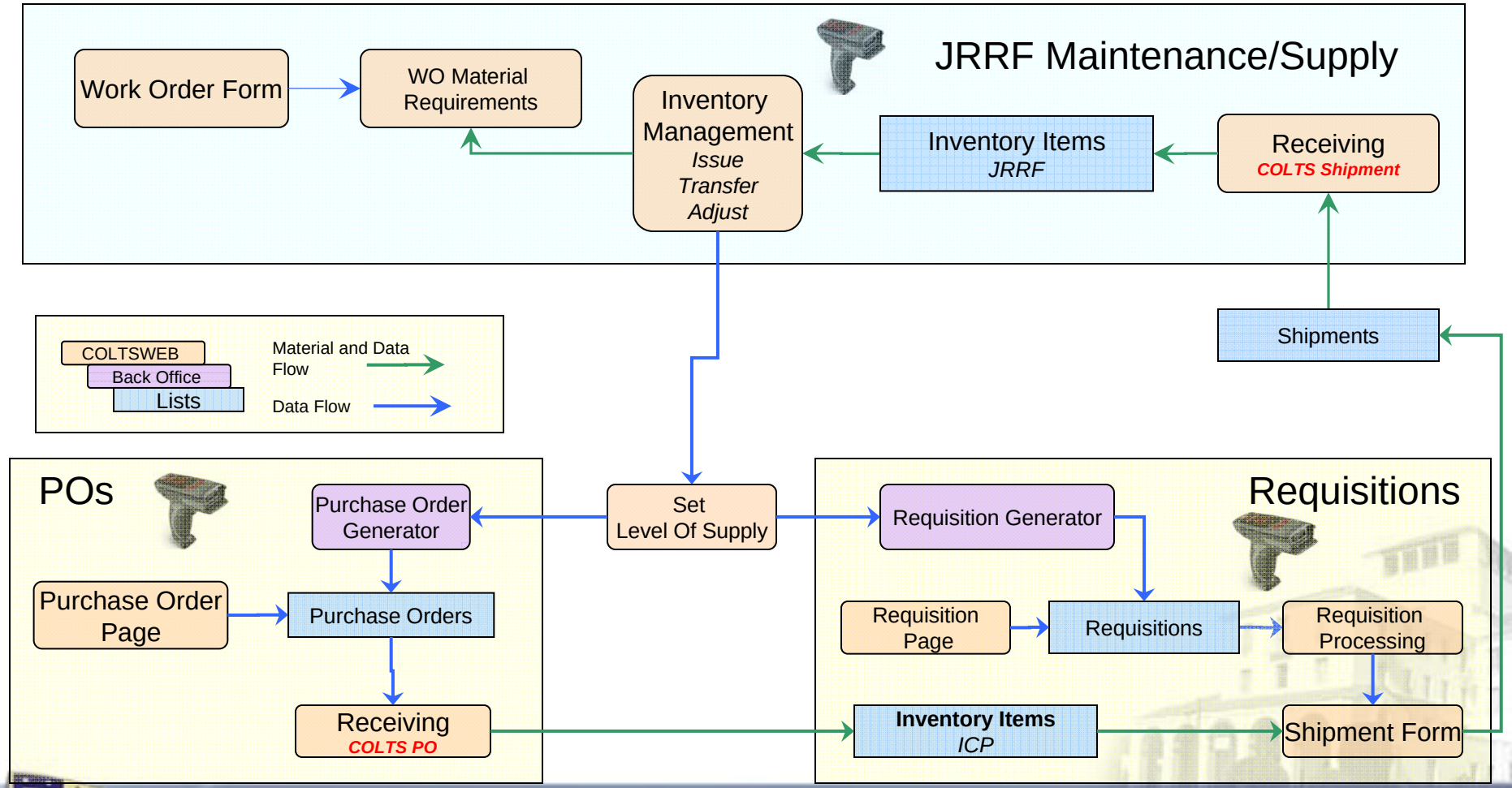
JRRF Prior to IUID integration

Each Keyboard represents opportunity for error



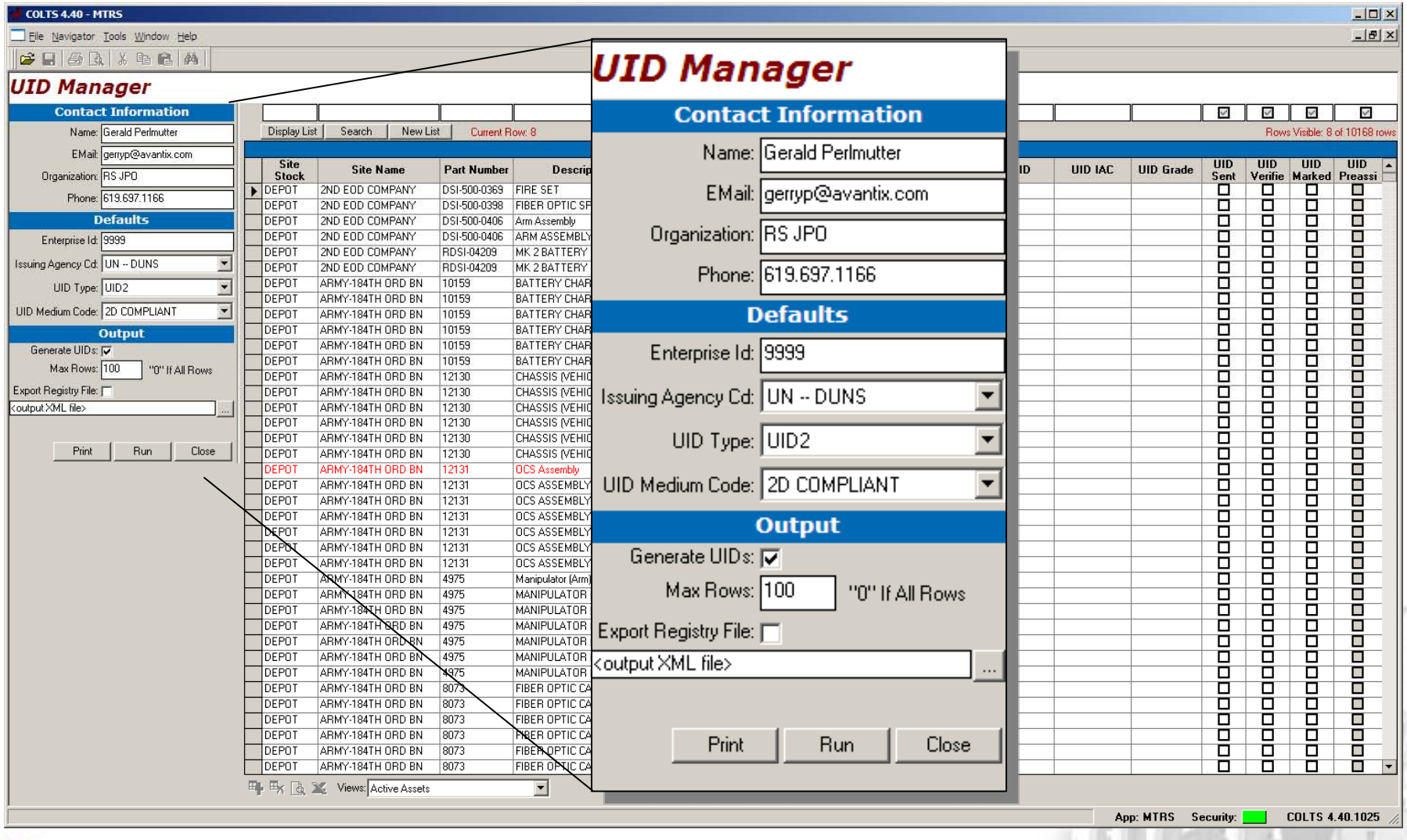
JRRF Prior to IUID integration

Each Scanner represent a process streamlined and error elimination.



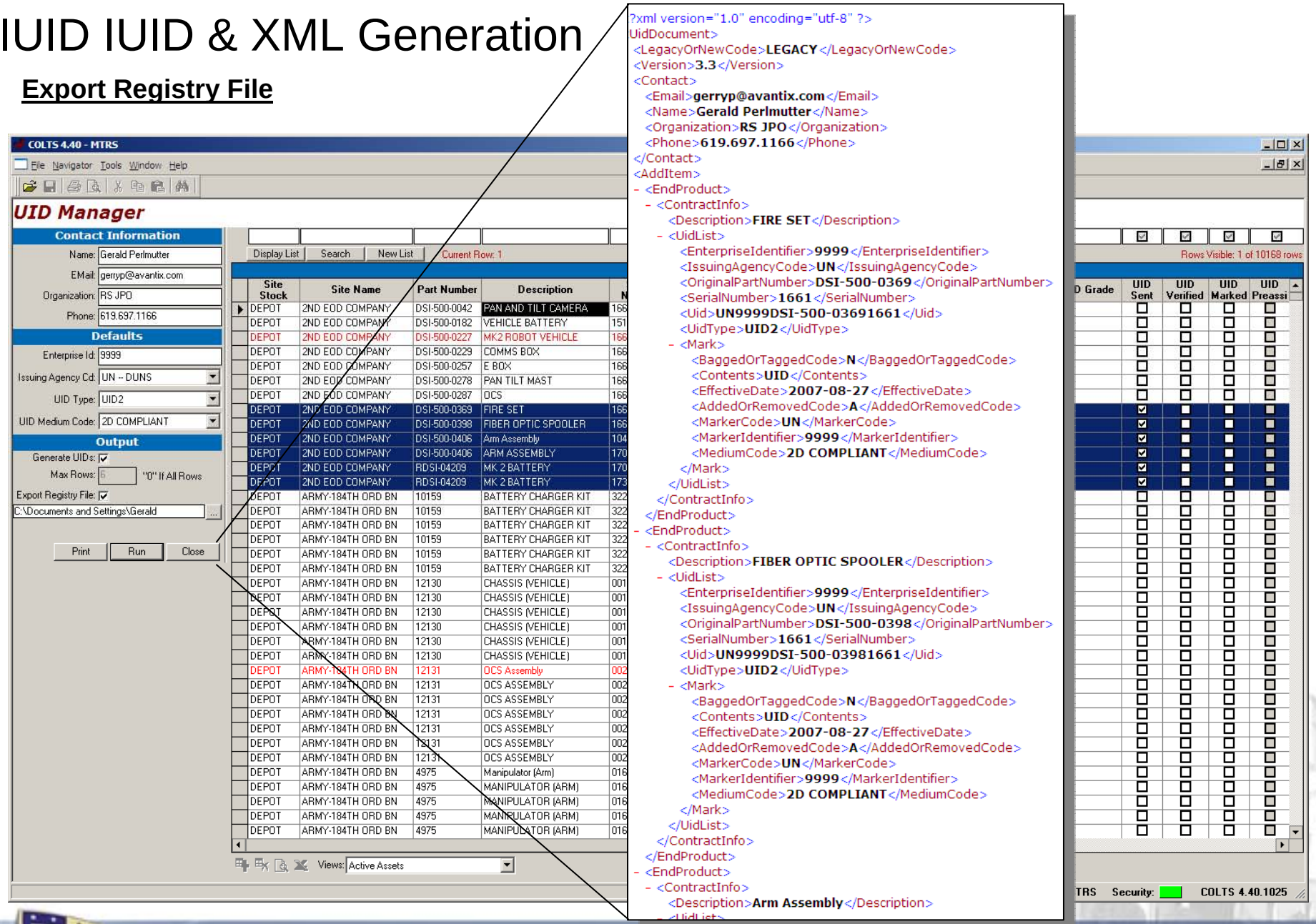
IUID Pedigree Data Input

Enter Contact Information, Defaults and Output



IUID IUID & XML Generation

Export Registry File




```
?xml version="1.0" encoding="utf-8" ?>
UidDocument>
 <LegacyOrNewCode>LEGACY</LegacyOrNewCode>
 <Version>3.3</Version>
 <Contact>
   <Email>gerryp@avantix.com</Email>
   <Name>Gerald Perlmutter</Name>
   <Organization>RS JPO</Organization>
   <Phone>619.697.1166</Phone>
 </Contact>
 <AddItem>
 - <EndProduct>
   - <ContractInfo>
       <Description>FIRE SET</Description>
     - <UidList>
         <EnterpriseIdentifier>9999</EnterpriseIdentifier>
         <IssuingAgencyCode>UN</IssuingAgencyCode>
         <OriginalPartNumber>DSI-500-0369</OriginalPartNumber>
         <SerialNumber>1661</SerialNumber>
         <Uid>UN9999DSI-500-03691661</Uid>
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       - <Mark>
           <BaggedOrTaggedCode>N</BaggedOrTaggedCode>
           <Contents>UID</Contents>
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           <MarkerIdentifier>9999</MarkerIdentifier>
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         </Mark>
       </UidList>
     </ContractInfo>
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 - <EndProduct>
   - <ContractInfo>
       <Description>Arm Assembly</Description>
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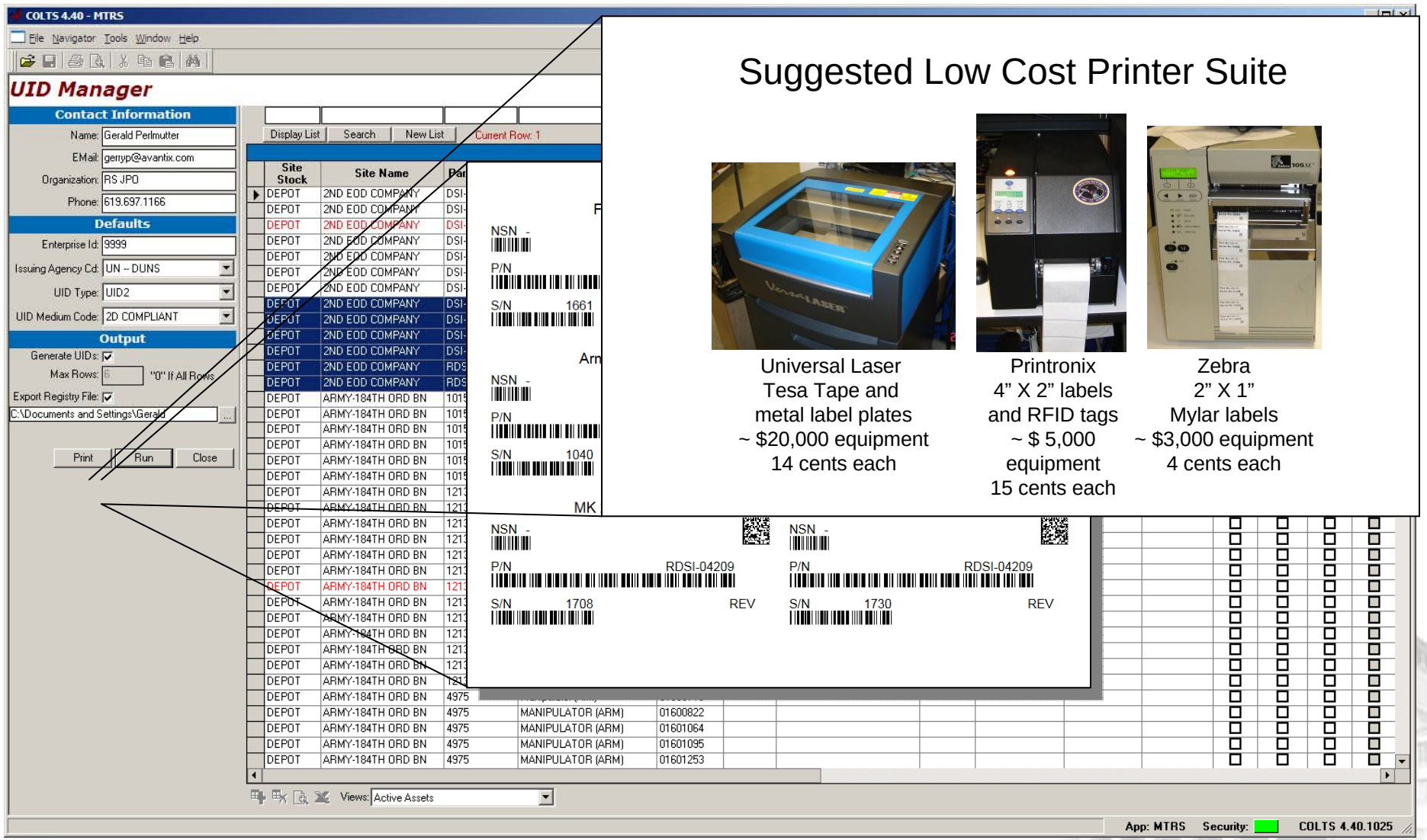
IUID Printing options

Print



Suggested Low Cost Printer Suite

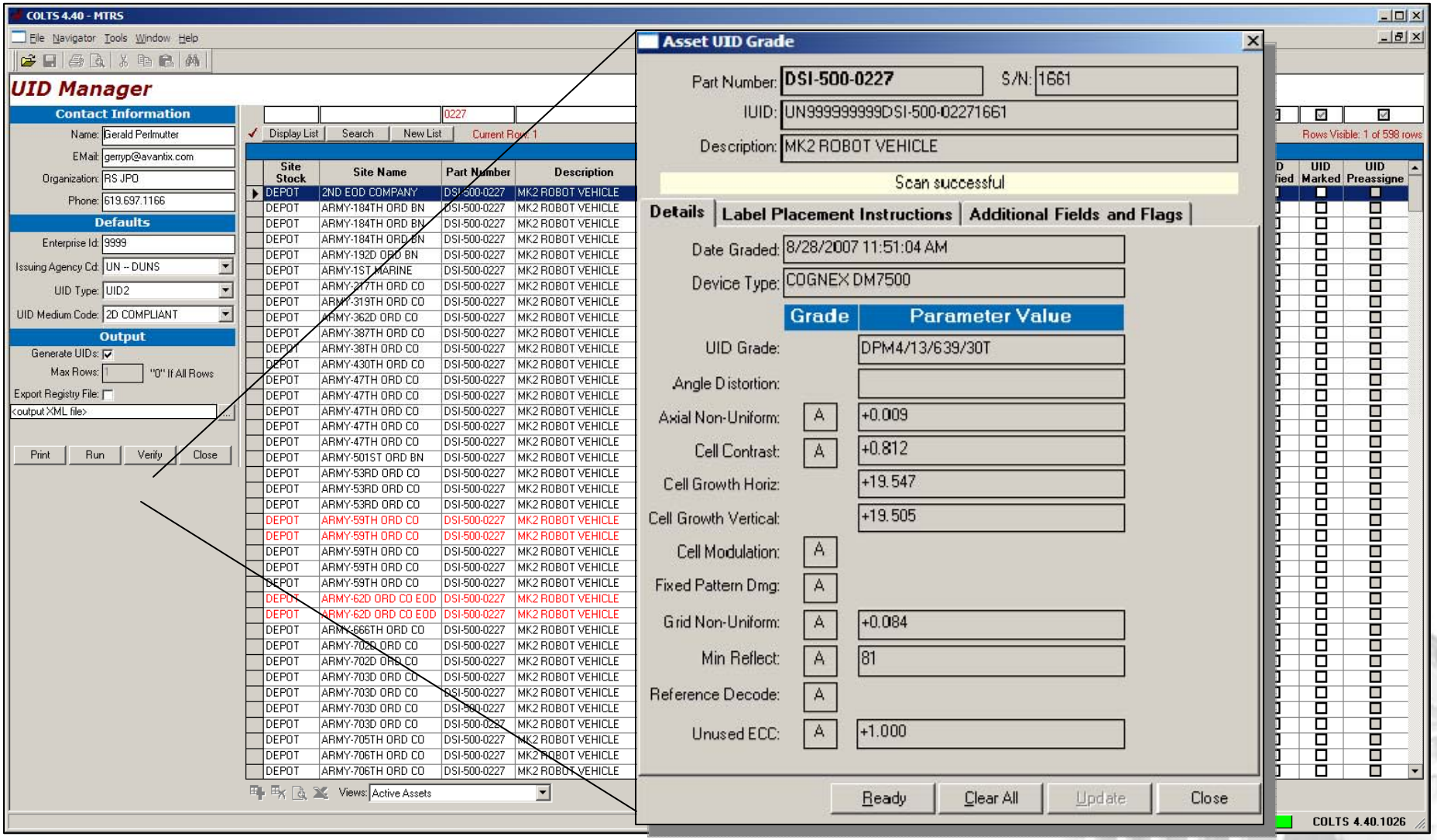
Universal Laser
Tesa Tape and
metal label plates
~ $20,000 equipment
14 cents each

Printronix
4” X 2” labels
and RFID tags
~ $ 5,000
equipment
15 cents each

Zebra
2” X 1”
Mylar labels
~ $3,000 equipment
4 cents each

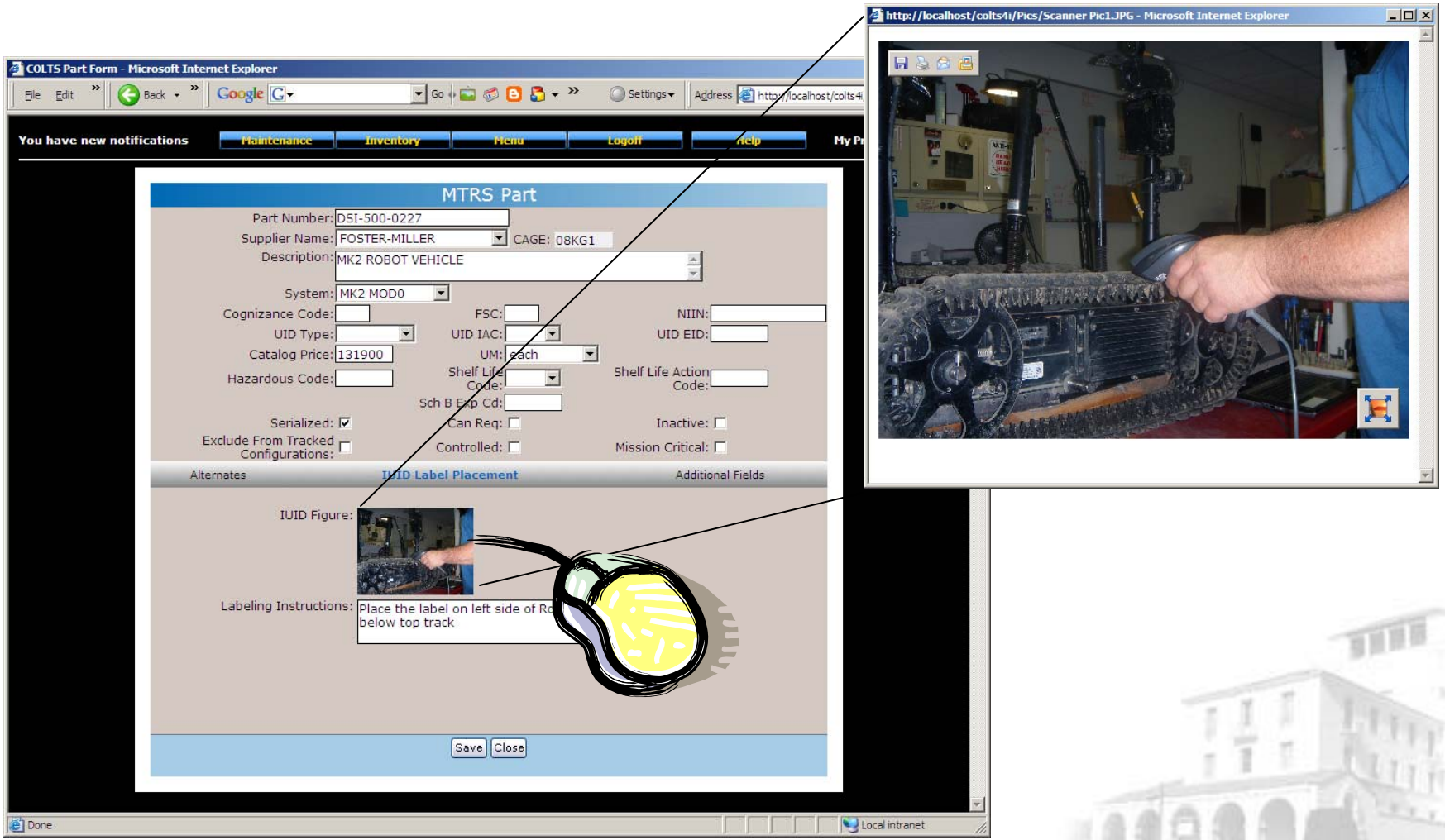
IUID Data Verification Process

Verify



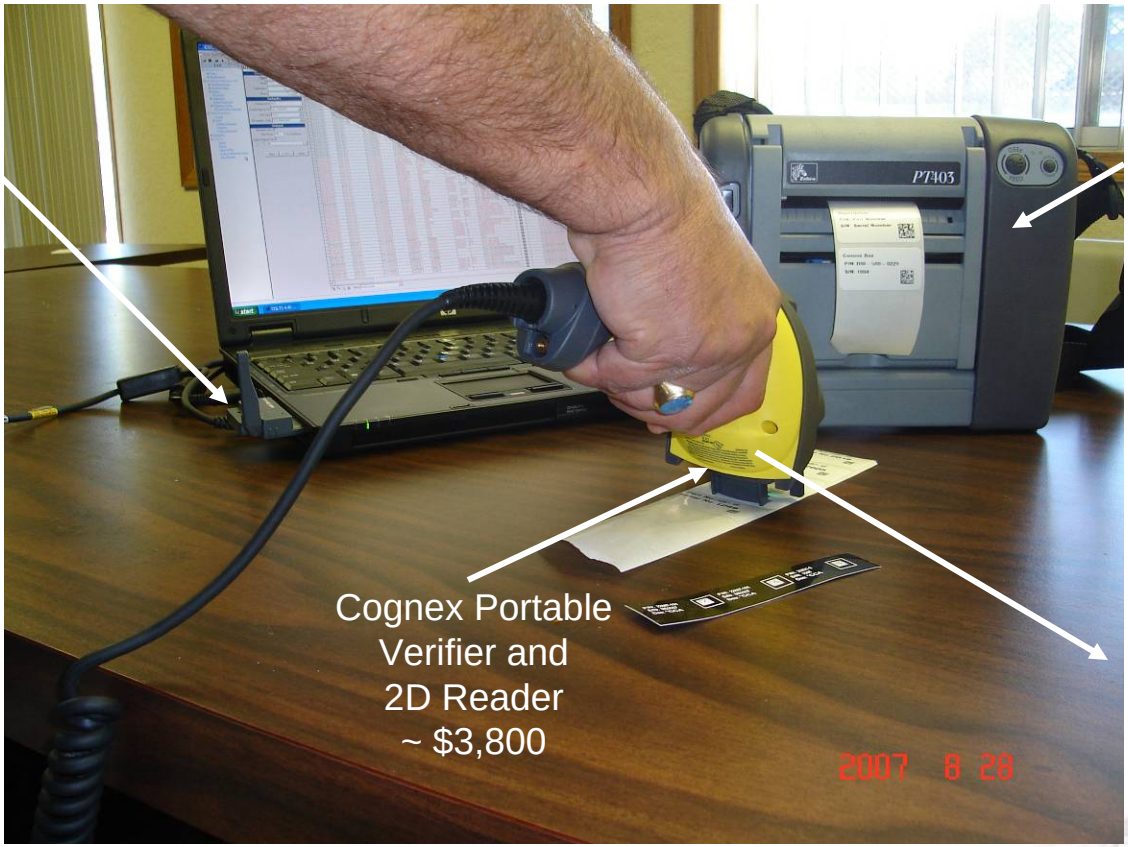
IUID Marking Instructions

Step Six: Secure Label



IUID Portable On-Site Suite

Air Card for off site Citrix connection to SCM Server $60/month



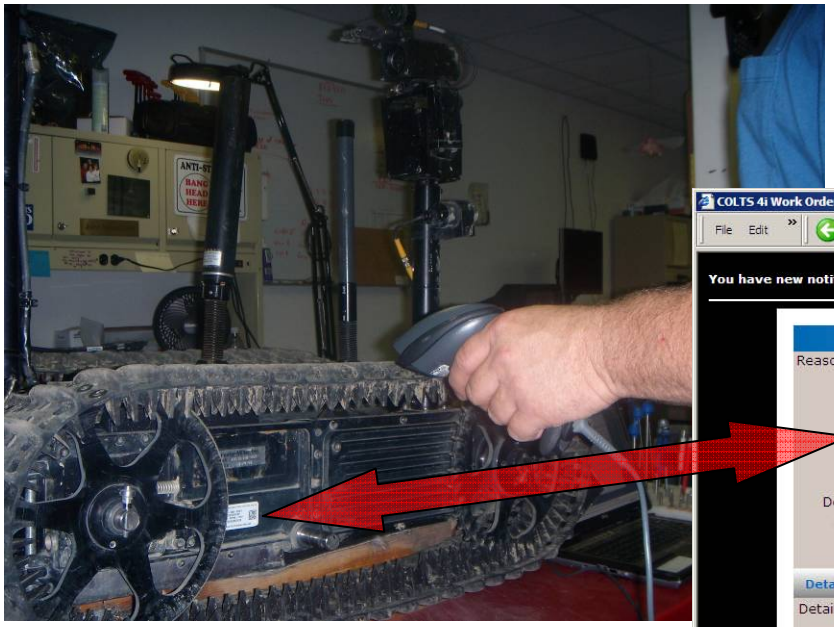
Cognex Portable Verifier and 2D Reader ~ $3,800

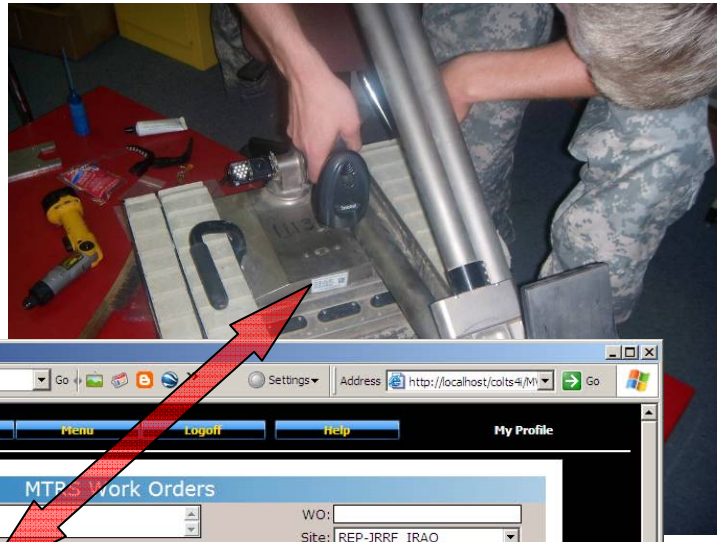
Zebra PT403 Portable Rugged Printer 2” x 1” Mylar ~ $1000 each

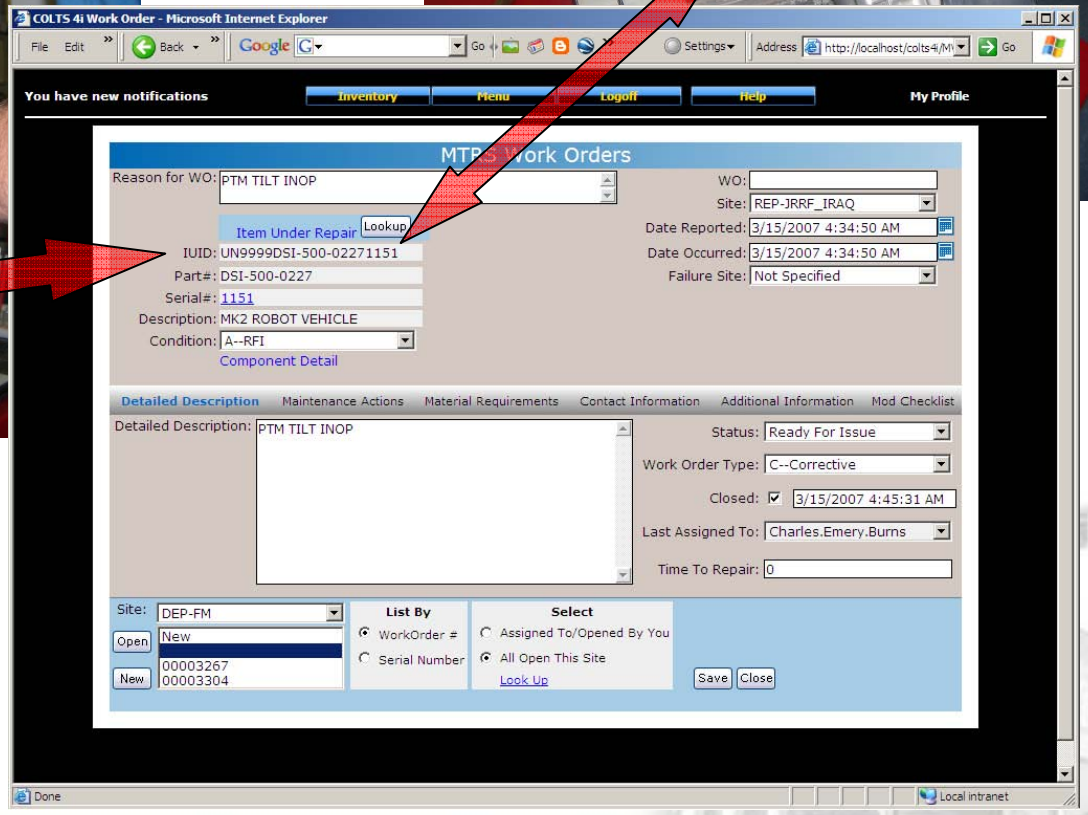
Note: this Verifier is NMCI compatible and does not need special software.

IUID and Maintenance

Maintenance Management





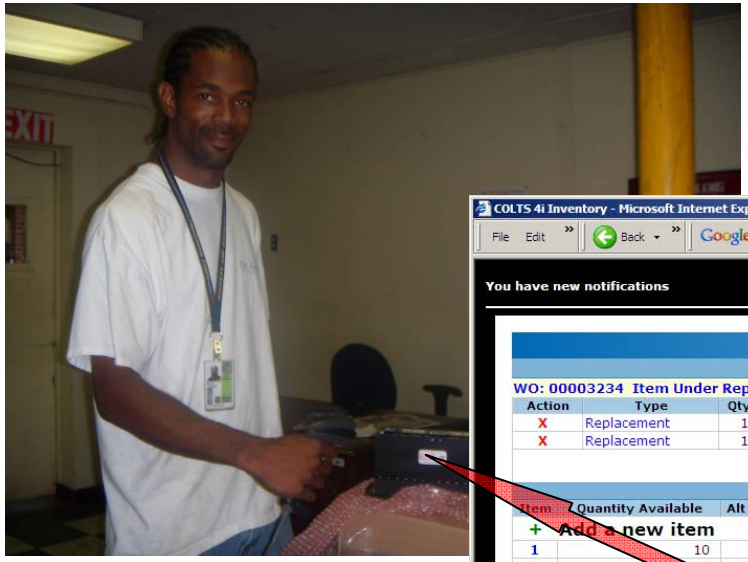


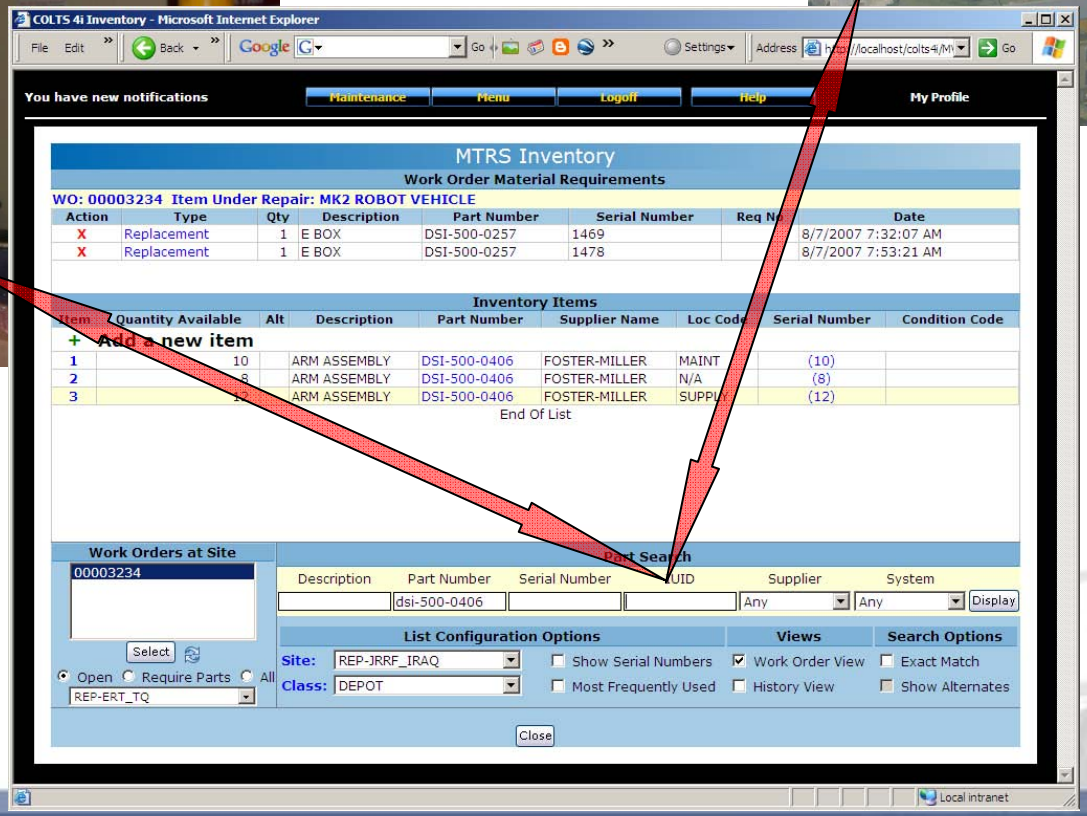
One Scan opens a Work Order and transfers equipment for Asset and Property Book Management.

IUID and Supply & Shipping

Shipping, Receiving & Inventory Management

Scan to identify issued inventory, items shipped (DD1149). and Items received.





Scan to ID items shipped & Received (DD1149)

Scan to identify issued inventory

Just the facts (1 Jan 07 – 31 Dec 07)

- COLTS Supply & Maintenance Data
  - 6073 Work orders completed
  - 26,375 maintenance actions
  - 64,419 Inventory events (Parts movement)
  - 78,467 Asset events (Robot actions/movement/repair, etc)
  - 4,816 Items shipped
  - 64 EOD/Engineer robots rebuilt from a destroyed condition. Cost savings approximately 3.2 million dollars.

- AIT, IUID/RFID integration saves the RSJPO time, money and ultimately lives on the battlefield.
  - No more “lost” data due to human error
  - Shorter repair cycle time as a result of IUID “scan in & scan out”
  - More fidelity of data tracked in COLTS due to IUID decision process.
  - Routine logistics processes streamlined with IUID and hand scanner.
  - Configuration management integrated with all SCM actions. SIM is a reality

- Operational rate on all NS-E/COTS supported platforms has been in excess of 98% since Apr 05.

- In excess of 3307 soldiers trained on robotics operation

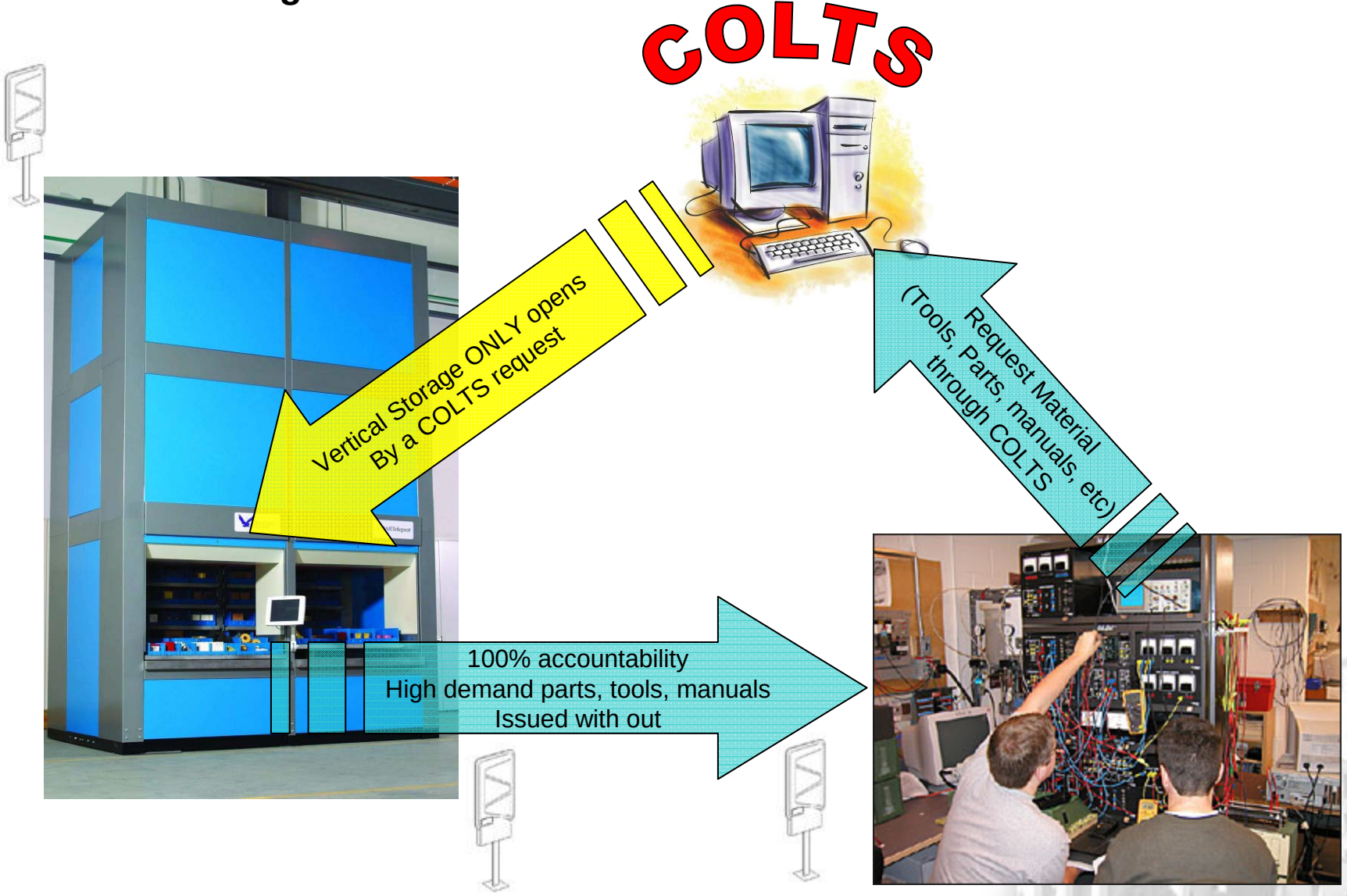
Return on Investment

- A misplaced hyphen cost $280K
- IUID enables Serialized Item Maintenance (SIM is a DoD Mandate)
  - IUID Enables real time configuration management
  - IUID Saves repair parts cost
    - Aug 06-Mar 07 $29M for repair parts on 1 vendor
    - Aug 07-Mar 08 $ 5M for repair parts on same vendor
- IUID eliminates human induced error
  - Average human has a typing error rate 5.47%. For every 100 key strokes 6 will be wrong

Future Operations; Where we are going

- Vertical storage (Self Issue) (Feb 2008)
  - 100% automated accountability COLTS opens the drawer not the user
  - High use items will be co-located with technicians
  - Tool room functions
- Integrated RFID (Apr 2008)
  - End items will receive active (aRFID) / (pRFID) passive permanent RFID
  - ICP will utilized aRFID / pRFID to streamline operations
- Integrate CBM+ (Conditioned Based Maintenance)
  - We want the robots to tell us (JRRF) when they need service
- Institutionalize the JRRF process for NS-E/COTS sustainment
  - Establish a Joint Service approach
  - Staff and train a Joint Reserve organization to be reactive to mobilization and NS-E/COTS support (Train, Maintain, Supply)
  - Stop inventing the wheel at every conflict. Institutionalize the innovative process

Vertical Storage



Questions?